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RACIAL PREHISTORY IN THE SOUTHWEST
AND
THE HAWIKUH ZUNIS

BY

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RACIAL PREHISTORY IN THE SOUTHWEST
AND THE HAWIKUH ZUNIS

INTRODUCTION

IN ORDER for the reader to understand the orientation and mode of presentation of the material in this paper, it is pertinent to point out the fact that this monograph was not originally intended to be published as a separate. It was initially an integral part of a much larger report dealing with the racial history and physical complex of the present Zuni Indians of New Mexico. This study began in 1933 under the auspices of the National Research Council, the Department of Anthropology and Peabody Museum of Harvard University. The author held a National Research Council Fellowship in the Biological Sciences during the period 1933-35. Part I of the report consisted of a detailed description and analysis of the physical characteristics of the living Zuni Indians based on data collected by the author in 1933. Part II, which covers the material in this publication, grew out of an attempt to determine what historical changes if any had taken place in the somatological complex of the Zuni Indians and to relate the Zunis from the point of view of time and culture to the general Southwest area and particularly to the Pueblo region of the past as well as its present extension. As a natural result the primary orientation centered around the analysis and comparison of Hrdlička's series of Old Zuni crania obtained from the Hawikuh excavations.¹ It was soon apparent, however, that the relationships exposed by the comparisons

of the Old Zuni material with other series of crania in the Southwest area brought into focus a much larger and more important problem than the immediate one under consideration. New light appeared to be shed upon the racial history of the Southwest area with special implications relative to the Basket Maker-Pueblo transitional period.

A résumé of the essential findings of Part II was presented as a paper at the seventh annual meeting of the American Association of Physical Anthropologists at Yale University in the spring of 1936. The abstract was subsequently published in the *American Journal of Physical Anthropology*.²

For a variety of reasons, the publication of all the material, including the analysis of the living and the skeletal data, in a single report has been delayed. However, since the appearance of the abstract has aroused a not inconsiderable interest among students of Southwestern prehistory, it was felt desirable to split the original report and publish the Part II section in its present form. No essential changes have been made in the arrangement of the material from its original compilation. The rather detailed description and analysis of the Old Hawikuh Zuni crania have been retained. In this manner, it is hoped that when the comprehensive report on the anthropometry of the living Zuni Indians is published much unnecessary duplication will be avoided.

¹ Hrdlička, 1931.

² Seltzer, 1936.

DESCRIPTION OF OLD HAWIKUH ZUNIS

FOR the Zuni skeletal material which we are here to deal with we are primarily indebted to F. W. Hodge. His splendid excavations at the Old Hawikuh site on the Zuni Reservation from 1917 on revealed a large number of well-preserved burials.¹ That these skeletons represent Zunis is vouchsafed by Hodge who says in part that they were from the "ruined pueblo of Hawikuh, one of the celebrated Seven Cities of Cibola of the sixteenth century, occupied by the ancestors of the present Zuni Indians of western central New Mexico."

Inasmuch as Hodge assures us that most of the skeletal material was secured from excavations belonging to post-Spanish times, we must assign to this series a dating which would place it at least in the Early Spanish period.²

The task of examination and measurement of the skeletal collection was accomplished by Dr. Aleš Hrdlička, who presented the raw data in his *Catalogue of Human Crania*.³ The data consist of cranial measurements and indices of thirty-five undeformed males, fifty-one undeformed females, fifteen deformed males, and eighteen deformed females, all adults. For use in this particular analysis we have selected the undeformed male series and, in order that we might have a more reliable basis for comparison than is to be had from averages alone, it has been found necessary to calculate from the data the following statistical constants: means, standard deviations, coefficients of variation, and their respective probable errors. In addition we have added new calculations of the length-height index, the gnathic index, and the palatal index. With respect to the latter we have simply reversed the basis of calculation from considering the palatal breadth as a percentage of the length to computing the length as a percentage of the breadth.⁴

Table 1 contains the new figures for the cranial measurements and indices of the unde-

formed male series of Old Hawikuh Zunis. If we consider the question of head size first, we find the Old Zuni cranial vault to be surprisingly small indeed. The mean cranial capacity is given as 1302.60 cubic centimeters and the cranial module as only 147.60. Hrdlička⁵ has already directed attention to the typically small size of the Pueblo skull and has suggested that this condition would indicate the Pueblos to be a somewhat weakened group. This supposition is not supported, however, by the absolute size of the other dimensions of the skull, particularly with reference to the facial skeleton, the height of the cranial vault itself, and the height of the symphysis of the lower jaw. We would rather hold to the opinion that the very small size of the Zuni cranial vault is essentially an expression of the inherent genetic processes of the group.

In absolute dimensions the cranial vault is definitely short and narrow, but with reference to its shape it may be described as being moderately long and narrow. Mean glabella-occipital length is 175.76 millimeters and maximum breadth 133.43 millimeters. The relationship of these diameters as expressed by the cranial index of 75.91 is low mesocephaly, leaning towards dolichocephaly. If we examine the tabulation of individuals on the basis of the divisions of the cranial index as given in table 2, we find that about one-third (32.35 per cent) of the skulls are dolichocephalic, 52.94 per cent are mesocephalic, and only 14.71 per cent are brachycephalic. The most dolichocephalic skull of the lot has an index of 68 and the most brachycephalic an index of 84. It is clear, moreover, that the low value of the mean cranial index of the Old Hawikuh Zunis is essentially the result of the narrowness of the cranial vault rather than to any expression of great length.

The Zuni skull vault is high in absolute dimensions and in relative proportions. Mean

¹ Hodge, 1917.

² Hodge, 1917.

³ Hrdlička, 1931.

⁴ This was done in order to make the palatal index conform to the more standard procedure.

⁵ Hrdlička, 1931.

TABLE 1. — MEASUREMENTS AND INDICES OF OLD HAWIKUH ZUNI CRANIA *

UNDEFORMED MALES					
MEASUREMENTS	No.	RANGE	MEAN	S.D.	C.V.
Glabello-occipital length	34	168-188	175.76 ± 0.63	5.48 ± 0.45	3.12 ± 0.26
Maximum breadth	35	123-145	133.43 ± 0.61	5.32 ± 0.43	3.99 ± 0.32
Basion-bregma height	30	127-142	133.53 ± 0.46	3.70 ± 0.32	2.77 ± 0.24
Bizygomatic diameter	31	125-145	134.45 ± 0.50	4.16 ± 0.36	3.09 ± 0.26
Nasion-menton height	29	113-134	121.90 ± 0.60	4.82 ± 0.43	3.95 ± 0.35
Nasion-prosthion height	32	66-81	73.34 ± 0.41	3.44 ± 0.29	4.69 ± 0.40
Orbit height, right	30	32.5-37.5	34.75 ± 0.15	1.25 ± 0.11	3.60 ± 0.31
Orbit height, left	30	32.0-39.0	35.09 ± 0.19	1.58 ± 0.14	4.50 ± 0.39
Orbit breadth, right	30	33.5-41.0	38.02 ± 0.18	1.48 ± 0.13	3.89 ± 0.34
Orbit breadth, left	30	34.0-41.0	37.75 ± 0.14	1.14 ± 0.10	3.02 ± 0.26
Basion-nasion length	27	92-110	99.48 ± 0.54	4.19 ± 0.38	4.21 ± 0.38
Basion-prosthion length	23	86-114	98.00 ± 0.79	5.60 ± 0.56	5.71 ± 0.57
Nasal height	32	46-56	50.97 ± 0.27	2.23 ± 0.19	4.38 ± 0.37
Nasal breadth	32	22-28	25.16 ± 0.18	1.51 ± 0.13	6.00 ± 0.51
Palate length	27	48-59	54.22 ± 0.36	2.74 ± 0.25	5.05 ± 0.46
Palate breadth	27	59-71	64.74 ± 0.38	2.93 ± 0.27	4.53 ± 0.42
Height of symphysis	30	31-43	36.53 ± 0.33	2.65 ± 0.23	7.25 ± 0.63
Facial angle	23	64-76	69.83 ± 0.41	2.94 ± 0.29	4.21 ± 0.42
Alveolar angle	23	44-61	52.43 ± 0.68	4.80 ± 0.48	9.16 ± 0.91
Cranial capacity	27	1145-1470	1302.60 ± 10.90	84.00 ± 7.71	6.45 ± 0.59
Cranial module	30	142-153	147.60 ± 0.38	3.12 ± 0.27	2.11 ± 0.18
INDICES					
Cranial index	34	68-84	75.91 ± 0.46	4.01 ± 0.33	5.28 ± 0.43
Length-height index	30	69-81	76.10 ± 0.34	2.76 ± 0.24	3.63 ± 0.32
Breadth-height index	30	93-110	100.23 ± 0.56	4.58 ± 0.40	4.57 ± 0.40
Mean height index	30	81-91	86.33 ± 0.32	2.60 ± 0.23	3.01 ± 0.26
Total facial index	28	83-102	90.43 ± 0.54	4.22 ± 0.38	4.67 ± 0.42
Upper facial index	30	48-62	54.37 ± 0.37	2.99 ± 0.26	5.50 ± 0.48
Orbital index, right	30	83-103	91.70 ± 0.43	3.49 ± 0.30	3.81 ± 0.33
Orbital index, left	30	86-110	93.10 ± 0.58	4.73 ± 0.41	5.08 ± 0.44
Nasal index	32	43-56	49.53 ± 0.38	3.20 ± 0.27	6.46 ± 0.54
Palatal index	27	107-138	119.58 ± 1.03	7.90 ± 0.73	6.61 ± 0.61
Gnathic index	23	91-105	98.43 ± 0.52	3.67 ± 0.36	3.73 ± 0.37

* Calculated from data of Hrdlička, 1931.

basion-bregma height is 133.53 millimeters. The mean length-height and breadth-height indices are 76.10 and 100.23, respectively. The hypsicephalic character of the skull vault is clearly due to the great height not to the length, while the acrocephalic form is proportionately the expression of both the narrowness and the height of the skull. The classification of individuals on the basis of the division of indices shows 73.33 per cent to be hypsicephalic and 23.33 per cent as orthocephalic, and again 73.33 per cent are acrocephalic and 26.67 per cent metriocephalic.

The Old Zuni crania have relatively long and narrow faces. A mean maximum bizygomatic diameter of 134.45 millimeters is rather narrow for a North American Indian group, while the total face height of 121.90 millimeters

must be considered as being moderately long. On the basis of the arbitrary division of indices given in table 2, 64.29 per cent of the crania are classified as leptoprosopic (with indices over 89.6). The mean total facial index for the series as a whole, being 90.43, is hence also leptoprosopic. The component parts of the total facial length show no evidences of disproportion. Mean nasion-prosthion height of 73.34 millimeters is a good-sized dimension relative to the total face height, as is also the mean symphysial height of 36.53 millimeters.

The nasal dimensions are characteristically mesorrhine with a strong tendency towards platyrrhiny. Only 18.75 per cent of the individuals in the series have leptorrhine nasal indices. The rest are equally divided between the mesorrhine and platyrrhine classifications.

TABLE 2. — DIVISION OF INDICES OF OLD HAWIKUH ZUNI MALES UNDEFORMED

CRANIAL INDEX	Dolichocephalic (x-74.9)	Mesocephalic (75.-79.9)	Brachycephalic (80.-x)	Total
No.	11	18	5	34
Per cent	32.35	52.94	14.71	
LENGTH-HEIGHT INDEX	Chamaecephalic (x-69.5)	Orthocephalic (69.6-74.5)	Hypsicephalic (74.6-x)	Total
No.	1	7	22	30
Per cent	3.33	23.33	73.33	
BREADTH-HEIGHT INDEX	Tapeinocephalic (x-91.5)	Metriocephalic (91.6-97.5)	Acrocephalic (97.6-x)	Total
No.	0	8	22	30
Per cent	0	26.67	73.33	
TOTAL FACIAL INDEX	Euryprosopic (x-84.5)	Mesoprosopic (84.6-89.5)	Leptoprosopic (89.6-x)	Total
No.	2	8	18	28
Per cent	7.14	28.57	64.29	
UPPER FACIAL INDEX	Euryene (x-49.5)	Mesene (49.6-54.5)	Leptene (54.6-x)	Total
No.	2	14	14	30
Per cent	6.67	46.67	46.67	
ORBITAL INDEX	Chamaeconch (x-82.5)	Mesoconch (82.6-88.5)	Hypsiconch (88.6-x)	Total
No., right	0	7	23	30
Per cent	0	23.33	76.67	
No., left	0	2	28	30
Per cent	0	6.67	93.33	
NASAL INDEX	Leptorrhine (x-46.5)	Mesorrhine (46.6-50.5)	Platyrrhine (50.6-x)	Total
No.	6	13	13	32
Per cent	18.75	40.63	40.63	
PALATAL INDEX	Dolichuranic (x-109.5)	Mesuranic (109.6-114.5)	Brachyuranic (114.6-x)	Total
No.	1	7	19	27
Per cent	3.70	25.93	70.37	
GNATHIC INDEX	Orthognathous (x-97.5)	Mesognathous (97.6-102.5)	Prognathous (102.6-x)	Total
No.	11	8	4	23
Per cent	47.83	34.78	17.39	

The Old Zuni crania may be said to have high and moderately narrow orbits. In this connection a marked asymmetry may be observed between the right and left sides. The left orbit is considerably higher than the right, but by the same token the right side is broader than the left. The orbital indices show this asymmetry very clearly, the mean orbital index of the right side being 91.70 and that of the left 93.10. In spite of this asymmetry, we find that both the right and left orbits are strongly hypsiconch.

The absolute palatal dimensions of the Old Hawikuh Zuni crania are quite large with a mean length of 54.22 millimeters and a mean breadth of 64.74 millimeters. The proportions

of these dimensions, however, suggest a palate which is relatively short and broad. The mean palatal index falls into the brachyuranic class, as do 70.37 per cent of the individual crania of the series.

The length of the Zuni skull base as expressed by the basion-nasion length is quite short, with a mean length of 99.48 millimeters. Basion-prosthion length is also a relatively short diameter. The index of these dimensions (gnathic index) indicates the comparative protrusion or prognathism of the face. A mean gnathic index for undeformed Zuni male crania of 98.43 describes the Zunis as mesognathous with strong tendencies towards orthognathy. Individually, prognathous faces are seen in

TABLE 3. — COMPARISON OF MEASURES OF VARIABILITY BETWEEN OLD HAWIKUH ZUNI MALES AND PECOS TOTAL SERIES A MALES

MEASUREMENTS	STANDARD DEVIATIONS		COEFFICIENTS OF VARIATION	
	ZUNIS (35)	PECOS * (174)	ZUNIS (35)	PECOS * (174)
Glabello-occipital length	5.48±0.45	8.15± 0.58†	3.12±0.26	4.65±0.33†
Maximum breadth	5.32±0.43	6.14± 0.44†	3.99±0.32	4.45±0.32†
Basion-bregma height	3.70±0.32	6.49± 0.53†	2.77±0.24	4.73±0.39†
Bizygomatic diameter	4.16±0.36	6.17± 0.29	3.09±0.26	4.45±0.21
Nasion-menton height	4.82±0.43	5.54± 0.26	3.95±0.35	4.64±0.21
Nasion-prosthion height	3.44±0.29	3.95± 0.18	4.69±0.40	5.42±0.24
Orbit height, right	1.25±0.11	1.61± 0.07	3.60±0.31	4.62±0.20
Orbit height, left	1.58±0.14	1.60± 0.07	4.50±0.39	4.60±0.20
Orbit breadth, right	1.48±0.13	1.82± 0.08	3.89±0.34	4.56±0.20
Orbit breadth, left	1.14±0.10	1.89± 0.12	3.02±0.26	4.65±0.20
Basion-nasion length	4.19±0.38	3.78± 0.35†	4.21±0.38	3.68±0.34†
Basion-prosthion length	5.60±0.56	3.38± 0.32†	5.71±0.57	3.43±0.33†
Nasal height	2.23±0.19	2.74± 0.12	4.38±0.37	5.38±0.23
Nasal breadth	1.51±0.13	1.57± 0.07	6.00±0.51	7.08±0.26
Palate length	2.74±0.25	2.82± 0.13	5.05±0.46	5.12±0.24
Palate breadth	2.93±0.27	3.29± 0.16	4.53±0.42	5.02±0.24
Height of symphysis	2.65±0.23	2.50± 0.12	7.25±0.63	7.08±0.33
Cranial capacity	84.00±7.71	118.09±10.11†	6.45±0.59	8.82±0.76†
Cranial module	3.12±0.27	5.08± 0.42†	2.11±0.18	3.38±0.28†
INDICES				
Cranial index	4.01±0.33	4.81± 0.35†	5.28±0.43	6.14±0.45†
Length-height index	2.76±0.24	3.95± 0.32†	3.63±0.32	5.06±0.41†
Breadth-height index	4.58±0.40	4.90± 0.41†	4.57±0.40	4.93±0.41†
Total facial index	4.22±0.38	4.87± 0.25	4.67±0.42	5.68±0.29
Upper facial index	2.99±0.26	3.28± 0.16	5.50±0.48	6.30±0.32
Orbital index, right	3.49±0.30	4.57± 0.20‡	3.81±0.33	5.21±0.23‡
Orbital index, left	4.73±0.41	....	5.08±0.44	....
Nasal index	3.20±0.27	4.27± 0.18	6.46±0.54	8.46±0.39
Palatal index	7.90±0.73	6.42± 0.31	6.61±0.61	5.42±0.26
Gnathic index	3.67±0.36	3.84± 0.37†	3.73±0.37	4.00±0.38†
Average for 17 measurements §	3.19	3.73	4.34	4.92
Average for 8 indices || .....	4.17	4.54	5.06	5.75

* Hooton, 1930.

† Undeformed, Total Series A Males (46).

‡ Mean orbital index.

§ Omitting cranial capacity and cranial module.

|| Omitting orbital index.

17.39 per cent of cases, the mesognathous form in 34.78 per cent, and the orthognathous type in 47.83 per cent.

This Zunis series is no heterogeneous collection of individual crania. The computed means, which serve as representative values for the various features of the group, are highly distinctive. Considering the limited size of the series on hand, the probable errors are very

small indeed. A rapid survey of the standard deviations and coefficients of variation of the different measures and proportions shows how homogeneous this Zuni sample is. In order further to illustrate this point, in table 3 I have contrasted the Old Zunis with Hooton's Pecos Total Series A group⁶ with respect to their measures of variability. From these data it may be seen that the Old Zuni series is much less variable in both measurements and indices than the Pecos group. The standard deviations of

⁶ Hooton, 1930.

the Zunis are smaller than those of the Pecos series in all instances except in the case of basion-nasion length, basion-prosthion length, and the palatal index. With respect to the coefficients of variation the Zunis have smaller constants in all features but basion-nasion length, height of symphysis, and the palatal index. The average of the standard deviations for the Zunis in seventeen measurements amounts to only 3.19 and for the larger Pecos series to 3.73. The average of the standard deviations for eight indices for the Zunis is 4.17 and for the Pecos group 4.54. Similar averages for the coefficients of variation of the Zunis and the Pecos crania are for measurements 4.34 and 4.92, respectively, again for indices 5.06 and 5.75, respectively.

The question as to whether or not the Old Hawikuh Zuni series could be broken down into subgroups or subtypes has also been investigated. The data were carefully scrutinized for the segregation of crania representing diverse types. No clear-cut segregation of this nature was apparent. Particular attention was directed toward the small brachycephalic element. Scattergrams were plotted, showing the distribution of the cranial index with a number of other indices and measurements such as the nasal index, upper facial index, total facial index, external palatal index, orbital index, bizygomatic diameter, basion-nasion length, basion-alveon length, menton-nasion height, and the cranial capacity. In all instances, with the exception of the cranial capacity, the distribution of the cranial index appeared to be more or less independent of the distributions of the other features. As a result, it seems safe to assume that the Old Hawikuh Zuni series represents a fairly homogeneous group, the variations within the series being the normal variation to be expected in such a population.

From the above description of the Old Zuni Hawikuh crania it must be clear to the reader that we are not dealing with an intermediate or generalized physical type. The physical features of the group are, on the contrary, in many respects highly distinctive in character. Accordingly, in our search for racial origins and affiliations among other comparative series we can be guided by this condition to arrive at safer deductions and conclusions than were possible, if this series was more generalized. A review of those features which characterize the Zuni physical type and which can be used for diagnostic purposes should include such traits as small-headedness, which may be illustrated by the size of the cranial capacity and the cranial module, and the presence of a short skull length and a narrow skull width, giving a cranial index of a low mesocephalic or very high dolichocephalic rank. Among other characteristics are a skull vault which is high in absolute dimensions and in relative proportions, giving acrocephalic and hypsicephalic mean indices, a long total face height, and a distinctively narrow bizygomatic breadth. Total facial proportions should be leptoprosopic and nasion-prosthion height and the height of the symphysis of the lower jaw should be large and not in disproportion to the total facial length. The nasal dimensions should give a strongly mesorrhine index and the orbits should be high and moderately narrow with an index falling well into the hypsiconch class. With respect to the palate, the dimensions should be long and broad, but the proportions relatively short and broad with a mean brachyuranic index. And finally, from a combination of a short basion-nasion length and a relatively short basion-prosthion length, the protrusion of the face should be slightly mesognathous.

OLD ZUNI (HAWIKUH) AFFINITIES

IN THIS section we shall examine several series of skeletal material from the Southwest for evidences of basic relationship and affiliation. We shall also attempt to determine whether the Zuni physical type was anomalous and unique in the Southwestern area, or on the other hand merely a representative branch of a widely distributed stock.

It is only proper that we begin our comparative study with an examination of the earliest remains from the Southwestern area, that of the Basket Makers. One of the best series available for this purpose is the Grand Gulch Southeastern Utah collection, the measurements of which have been presented by Hrdlička in his *Catalogue of Human Crania*.¹

In table 4, the Old Zuni Hawikuh crania are compared with those of the Southeastern Utah Basket Makers. Since both series were measured by Dr. Hrdlička, this comparison is particularly reliable, in that the errors resulting from the personal equations of different observers are eliminated. If we examine the array of means, the first comprehensive estimate of extent of similarity may be obtained from the summary average of the differences. In the case of the measurements, the average difference between the means is but 0.94 millimeters and for the indices only 1.14 index units. Obviously, the two groups have decided resemblances in both dimensions and proportions. A more detailed inspection of the individual features reveals the fact that the size of the skull vault of the Old Zuni crania, as indicated by the cranial module and the cranial capacity, is somewhat smaller than that of the Utah Basket Makers. However, inasmuch as the differences are less than three times their probable errors, they cannot be regarded as being

significantly different. The only two statistically significant divergencies to be found for the measurements are in glabello-occipital length and palate breadth. The Utah Basket Makers are 4.97 millimeters greater in the length of the skull vault than the Old Zuni and 1.74 millimeters larger in the breadth of the palate. The Utah Basket Makers are somewhat narrower in the width of the cranial vault, but not significantly so. In all the other dimensions, basion-bregma height, bizygomatic diameter, nasion-menton height, nasion-prosthion height, orbit height and breadth, nasal height and breadth, basion-nasion length, basion-prosthion length, and the height of the symphysis of the lower jaw, the two groups are virtually identical. With respect to the indices, as a result of the longer skull vault of the Basket Makers, we find that the latter series is 2.91 index units more dolichocephalic and 2.27 units more orthocephalic than the Old Zunis. Both these differences are statistically significant. But in regard to all the other proportions, the two groups again manifest unusual similarity. What we have here, then, are two series, which apart from the fact that one is longer and narrower in the skull vault than the other, are in other respects almost mirror images of each other. Although the magnitude of the difference of the vault length is enough to render the two groups statistically distinct, nevertheless, owing to their marked similarity in all other respects, it can be concluded that the Old Zunis are of the Basket Maker physical type.²

The significance of this relationship is of such magnitude that a further extension of this line of investigation with other groups of proven and suggested Basket Maker affinities

¹Hrdlička, 1931. The statistical constants for this series as well as for the others from Hrdlička's *Catalogue of Human Crania* have been calculated by the author in the same fashion as for the Old Zuni group.

²The fact that the Utah series is virtually identical with the Zunis, in all features with the exception of being more dolichocephalic, suggests the possibility of there being here a slight artificial selection with regard

to head form. Such a situation is not uncommon in the Southwest where collectors have made designations of cultural affinities to certain skeletal material solely on the criteria of the presence or absence of deformation, and on the degree of dolichocephaly or brachycephaly of the crania. If any selection of this type entered into the collection of the Utah series, it certainly would explain this anomalous situation.

TABLE 4. — DIFFERENCES OF MEANS OF UNDEFORMED OLD ZUNIS AND SOUTHEASTERN UTAH BASKET MAKERS *

MALES				
	OLD ZUNIS (35)	UTAH BASKET MAKERS (41)	DIFF.	X P.E.†
MEASUREMENTS				
Glabello-occipital length	175.76 ± 0.63	180.73 ± 0.45	+ 4.97	6.46
Maximum breadth	133.43 ± 0.61	131.88 ± 0.56	— 1.55	1.89
Basion-bregma height	133.53 ± 0.46	133.27 ± 0.44	— 0.26	0.41
Bizygomatic diameter	134.45 ± 0.50	134.78 ± 0.50	+ 0.33	0.46
Nasion-menton height	121.90 ± 0.60	121.10 ± 1.02	— 0.80	0.68
Nasion-prosthion height	73.34 ± 0.41	73.79 ± 0.50	+ 0.45	0.71
Orbit height, right	34.75 ± 0.15	34.75 ± 0.14	0.00	0.00
Orbit breadth, right	38.02 ± 0.18	37.98 ± 0.14	— 0.04	0.18
Nasal height	51.00 ± 0.27	51.37 ± 0.30	+ 0.37	0.93
Nasal breadth	25.16 ± 0.18	25.24 ± 0.13	+ 0.08	0.36
Basion-nasion length	99.48 ± 0.54	98.88 ± 0.40	— 0.60	0.90
Basion-prosthion length	98.00 ± 0.79	96.72 ± 0.54	— 1.28	1.35
Palate breadth	64.74 ± 0.38	66.48 ± 0.40	+ 1.74	3.16
Height of symphysis	36.53 ± 0.33	35.88 ± 0.44	— 0.65	1.18
Average difference .....	.....	.....	0.94	...
Cranial module	147.60 ± 0.38	148.67 ± 0.30	+ 1.07	2.14
Cranial capacity	1302.60 ± 10.90	1339.00 ± 9.21	+ 36.40	2.61
INDICES				
Length-breadth index	75.91 ± 0.46	73.00 ± 0.39	— 2.91	4.85
Length-height index	76.10 ± 0.34	73.83 ± 0.27	— 2.27	5.17
Breadth-height index	100.23 ± 0.56	101.53 ± 0.54	+ 1.30	1.69
Total facial index	90.43 ± 0.54	89.48 ± 0.67	— 0.95	1.10
Upper facial index	54.37 ± 0.37	54.75 ± 0.37	+ 0.38	0.72
Orbital index	91.70 ± 0.43	91.33 ± 0.42	— 0.37	0.62
Nasal index	49.53 ± 0.38	49.35 ± 0.32	— 0.18	0.37
Gnathic index	98.43 ± 0.52	97.69 ± 0.39	— 0.74	1.14
Average difference .....	.....	.....	1.14	...

* Calculated from data of Hrdlička, 1931.

† X P.E. refers to the number of times the probable error is contained in the difference.

would not be unprofitable. Accordingly, we have selected for comparison the Pecos "Basket Maker" series.³ This is a group of eight skulls chosen by Dr. Hooton out of his morphological sorting of the Pecos crania as representing a distinctive type. As a result of a painstaking analysis, Hooton was able to state that his Pecos "Basket Makers" "proved to be very similar to the authentic Basket Maker crania of Arizona," a collection of skeletons which is known to be definitely "associated with the Basket Maker and Post Basket Maker cultures."

Table 5 records the differences in means of measurements and indices between the Old Zuni Hawikuh crania and the Pecos "Basket Makers." If we glance over the column of differences, we are impressed with their small size and the paucity of significant deviations. The Pecos "Basket Makers" are significantly broader in the orbits and have significantly

wider palates, but in every other dimension the two groups are extraordinarily alike. Even with regard to the size of the cranial vaults there is almost identity, the mean cranial capacity for the Old Zunis being 1302.60 cubic centimeters and that of the Pecos "Basket Makers" 1306.67 cubic centimeters. When we turn to the consideration of the indices, we find a still greater manifestation of similarity. In no case do any of the differences attain statistical significance. As a matter of fact, except for the palatal index the largest difference is only 1.29 index units. The mean deviation between measurements of the two groups is 1.03 and for the indices 0.95. Inasmuch as the number and size of the differences between the Old Zunis and the Pecos "Basket Makers" are insufficient to make them statistically distinct groups, we can only conclude that they both are representatives of the same physical type.

³ Hooton, 1930.

TABLE 5. — DIFFERENCES OF MEANS OF UNDEFORMED OLD ZUNIS AND PECOS
"BASKET MAKERS"

MALES

MEASUREMENTS	OLD ZUNIS (34)	PECOS * "BASKET MAKERS" (8)	DIFF.	X P.E.
Glabello-occipital length	175.76± 0.63	176.88± 1.30†	+1.12	0.77
.....	.....	177.67‡	+1.91	...
Maximum breadth	133.43± 0.61	134.75± 1.32†	+1.32	0.91
.....	.....	132.83‡	-0.60	...
Basion-bregma height	133.53± 0.46	135.57± 1.50†	+2.04	1.30
.....	.....	135.00‡	+1.47	...
Bizygomatic diameter	134.45± 0.50	132.71± 1.22	-1.74	1.28
Nasion-menton height	121.90± 0.60	121.17± 1.27	-0.19	0.14
Nasion-prosthion height	73.34± 0.41	73.25± 0.58	-0.09	0.13
Orbit height, right	34.75± 0.15	35.43± 0.28	+0.68	2.13
Orbit breadth, right	38.02± 0.18	39.57± 0.39	+1.55	3.69
Nasal height	51.00± 0.27	51.38± 0.36	+0.38	0.84
Nasal breadth	25.16± 0.18	26.12± 0.37	+0.96	2.34
Basion-nasion length	99.48± 0.54	100.86± 0.40	+1.38	2.06
Basion-prosthion length	98.00± 0.79	98.29± 1.02	+0.29	0.22
Palate length	54.22± 0.36	55.17± 0.70	+0.95	1.20
Palate breadth	64.74± 0.38	67.33± 0.69	+2.59	3.28
Height of symphysis	36.53± 0.33	36.00± 0.67	-0.20	0.21
Average difference .....	.....	.....	1.03	...
Cranial module	147.60± 0.38	149.40‡	+1.80	...
Cranial capacity	1302.60± 10.90	1306.67± 31.50	+4.07	0.12
INDICES				
Length-breadth index	75.91± 0.46	76.38± 0.86†	+0.47	0.48
.....	.....	75.00‡	-0.91	...
Length-height index	76.10± 0.34	76.86± 1.10†	+0.76	0.66
.....	.....	76.20‡	+0.10	...
Breadth-height index	100.23± 0.56	100.00± 1.56†	-0.23	0.14
.....	.....	100.80‡	+0.57	...
Total facial index	90.43± 0.54	90.20± 1.45	-0.23	0.15
Upper facial index	54.37± 0.37	55.00± 0.44	+0.63	1.10
Orbital index	91.70± 0.43	90.43± 1.03	-1.27	1.14
Nasal index	49.53± 0.38	50.75± 0.72	+1.22	1.51
Gnathic index	98.43± 0.52	97.14± 0.88	-1.29	1.26
Palatal index	119.58± 1.03	122.00± 1.03	+2.42	1.66
Average difference .....	.....	.....	0.95	...

* Hooton, 1930.

† Deformed and undeformed crania.

‡ Undeformed crania.

The Old Zunis are next contrasted with a group of Arizona Basket Makers.⁴ This is a series of fifteen crania measured and used for comparative purposes by Dr. Hooton in his study of the *Indians of Pecos Pueblo*. Although they are not as homogeneous a group as the Utah Basket Makers, nevertheless, as they are of authentic Basket Maker and post-Basket Maker origin, they possess for our general purposes special significance.

In table 6, where the details of this compari-

son can be observed, it may be seen that the Arizona Basket Maker series is significantly longer-headed than the Old Zunis, more than 3 millimeters lower in the skull vault, and significantly broader in the orbits (0.98 mm.). With reference to the height of the face, however, we encounter a very interesting situation. The total face height (nasion-menton) is 121.90 millimeters for the Old Zunis and 116.25 millimeters for the Arizona Basket Makers. On the surface, therefore, it appears

⁴ Hooton, 1930.

TABLE 6. — DIFFERENCES OF MEANS OF UNDEFORMED OLD ZUNIS AND ARIZONA BASKET MAKERS

MALES

MEASUREMENTS	ARIZONA		DIFF.	X P.E.
	OLD ZUNIS (35)	BASKET MAKERS* (15)		
Glabello-occipital length	175.76 ± 0.63	179.87 ± 1.00	+4.11	3.48
Maximum breadth	133.43 ± 0.61	134.53 ± 0.86	+1.10	1.05
Basion-bregma height	133.53 ± 0.46	129.92 ± 0.77	-3.61	4.06
Bizygomatic diameter	134.45 ± 0.50	132.38 ± 0.80	-2.07	2.20
Nasion-menton height	121.90 ± 0.60	116.25 ± 1.56	-5.65	3.38
Nasion-prosthion height	73.34 ± 0.41	73.08 ± 0.91	-0.26	0.26
Orbit height, right	34.75 ± 0.15	34.23 ± 0.37	-0.52	1.30
Orbit breadth, right	38.02 ± 0.18	39.00 ± 0.20	+0.98	3.63
Nasal height	51.00 ± 0.27	50.80 ± 0.69	-0.20	0.27
Nasal breadth	25.16 ± 0.18	25.40 ± 0.44	+0.24	0.51
Basion-nasion length	99.48 ± 0.54	99.00 ± 0.48	-0.48	0.67
Basion-prosthion length	98.00 ± 0.79	97.15 ± 0.92	-0.85	0.73
Palate length	54.22 ± 0.36	54.69 ± 0.64	+0.47	0.89
Palate breadth	64.74 ± 0.38	64.67 ± 1.01	-0.07	0.06
Height of symphysis	36.53 ± 0.33	34.58 ± 0.50	-1.95	3.25
Average difference .....	.....	.....	1.50	...
INDICES				
Length-breadth index	75.91 ± 0.46	74.87 ± 0.64	-1.04	1.33
Length-height index	76.10 ± 0.34	72.62 ± 0.51	-3.48	5.61
Breadth-height index	100.23 ± 0.56	97.08 ± 0.49	-3.15	4.28
Total facial index	90.43 ± 0.54	86.85 ± 0.73	-3.58	3.94
Upper facial index	54.37 ± 0.37	54.83 ± 0.47	+0.46	0.77
Orbital index	91.70 ± 0.43	87.50 ± 0.89	-4.20	4.29
Nasal index	49.53 ± 0.38	50.13 ± 0.81	+0.60	0.67
Gnathic index	98.43 ± 0.52	98.23 ± 1.07	-0.20	0.17
Palatal index	119.58 ± 1.03	118.50 ± 1.85	+0.92	0.43
Average difference .....	.....	.....	1.96	...

* Hooton, 1930.

that the latter group is significantly shorter in this dimension by 5.65 millimeters. If we analyze the component parts of the measurement, we find that in nasion-prosthion height the two groups are virtually identical, 73.34 for the Old Zunis and 73.08 for the Arizona crania (difference 0.26 mm.). However, in the height of the symphysis of the lower jaw the Arizona Basket Makers are significantly shorter by 1.95 millimeters. It is thus apparent that the differences in the total face height of the two groups lies not only in the height of the lower jaw but also in the size of the teeth. If we subtract from the nasion-menton height the sum of the nasion-prosthion height and the height of the symphysis, we obtain 12.03 millimeters for the height of the Old

Zuni teeth and 8.59 for those of the Arizona Basket Makers.⁵ Accordingly, the true bony difference in the total face height instead of being 5.65 millimeters is but 2.21 millimeters, a figure which does not attain statistical significance and which reduces the apparently large disparity between the two groups.

If we return to the other measurements in our comparison, we find that substantial similarity can be observed for head breadth, face breadth, height of the orbits, nasal breadth and nasal height, basion-nasion length, basion-prosthion length, and the palatal dimensions. In indices, the Old Zunis and the Arizona Basket Makers show significant differences in the length-height index, the breadth-height index, and total facial and orbital indices.

⁵ Computed height of the teeth for Arizona Basket Makers is 8.59 millimeters. For Old Zunis height of teeth = 12.03 millimeters, Pecos "Basket Makers" = 11.13 millimeters, Utah Basket Makers = 11.43 milli-

mmeters, Bonito-Chaco = 14.57 millimeters, Petrified Forest = 12.15 millimeters, Puyé = 11.54 millimeters. The average for these six latter groups is 12.14 millimeters.

TABLE 7. — DIFFERENCES OF MEANS OF SOUTHEASTERN UTAH BASKET MAKERS AND ARIZONA BASKET MAKERS

MALES

MEASUREMENTS	UTAH BASKET MAKERS (41)	ARIZONA BASKET MAKERS (15)	DIFF.	X P.E.
Glabello-occipital length	180.73±0.45	179.87±1.00	-1.06	0.74
Maximum breadth	131.88±0.56	134.53±0.86	+2.65	2.41
Basion-bregma height	133.27±0.44	129.92±0.77	-3.35	3.81
Bizygomatic diameter	134.78±0.50	132.38±0.80	-2.40	2.55
Nasion-menton height	121.10±1.02	116.25±1.56	-4.83	2.60
Nasion-prosthion height	73.79±0.50	73.08±0.91	-0.71	0.68
Orbit height, right	34.75±0.14	34.23±0.37	-0.52	1.30
Orbit breadth, right	37.98±0.14	39.00±0.20	+1.02	4.08
Nasal height	51.37±0.30	50.80±0.69	-0.57	0.76
Nasal breadth	25.24±0.13	25.40±0.44	+0.16	0.35
Basion-nasion length	98.88±0.40	99.00±0.48	+0.12	0.19
Basion-prosthion length	96.72±0.54	97.15±0.92	+0.43	0.40
Palate breadth	66.48±0.40	64.67±1.01	-1.81	1.66
Height of symphysis	35.88±0.44	34.58±0.50	-1.30	1.97
Average difference .....	.....	.....	1.40	...
INDICES				
Length-breadth index	73.00±0.39	74.87±0.64	+1.87	2.49
Length-height index	73.83±0.27	72.62±0.51	-1.21	2.12
Breadth-height index	101.53±0.54	97.08±0.49	-4.45	6.10
Total facial index	89.48±0.67	86.85±0.73	-2.63	2.66
Upper facial index	54.75±0.37	54.83±0.47	+0.08	0.13
Orbital index	91.33±0.42	87.50±0.89	-3.83	3.91
Nasal index	49.35±0.32	50.13±0.81	+0.78	0.90
Gnathic index	97.69±0.39	98.23±1.07	+0.54	0.47
Average difference .....	.....	.....	1.92	...

If a correction were made for the difference in the height of the teeth, then there would be no significant disparity between the two groups in the total facial index. In the other proportions, the cranial, nasal, gnathic, and palatal indices, the differences are very small indeed. The average difference between the two groups in measurements is only 1.50 millimeters and for the indices 1.96 units. While it cannot be said that the Old Zunis resemble the Arizona Basket Makers as closely as they do the Utah group, the reader will agree that there are, certainly, sufficient grounds for suggesting a definite relationship between the Old Zunis and the Basket Makers of Arizona.

At this point it would seem proper to inquire how the Arizona Basket Makers compare in physical characteristics with the Utah Basket Makers. In table 7, we have set one against the other, their means, probable errors and differences between the means, as well as their x p.e.'s. A survey of the measurements

shows that in the cranial vault the Arizona group is shorter, wider, and lower-headed than the Utah series. In these dimensions, the head height differences is the only significant one, although the head breadth difference of 2.65 millimeters is more than twice the probable error of this deviation. The Arizona faces are narrower and shorter, shorter not in the upper face height, but in the lower jaw and especially in the reduced height of the teeth. In the breadth of the orbits, the Arizona group is significantly greater, but in the height of the orbits and in the nasal and cranial base dimensions the two groups are very much alike. And finally, the Utah crania have broader palates, but this difference of 1.81 millimeters does not attain statistical significance. The average difference for these measurements is 1.40 millimeters. With respect to the indices the Arizona Basket Makers, in contrast to the Utah group, are less dolichocephalic, more chamaecephalic, very significantly less acrocephalic, less leptoprosopic, and significantly less hypsi-

conch. In upper facial, nasal, and gnathic indices the two groups are very similar. The average difference for these indices amounts to 1.92 units.

Notwithstanding the fact that the number and size of the divergencies between the Arizona and Utah Basket Makers are enough to characterize them as statistically distinct groups, there can be no doubt that fundamentally they are of the same general type. In almost all instances where the differences become substantial, the Arizona series differs from the Utah Basket Makers in the same direction as it does from the Old Zuni crania. This lays additional emphasis on the relationship between the latter group and the Utah Basket Makers. It is also evident that the Old Zunis resemble the Utah Basket Makers more closely than the Arizona series and even more closely than the Utah resemble the Arizona Basket Makers. The average differences between the Old Zunis and the Utah Basket Makers is 0.94 for measurements and 1.14 for indices; between the Utah and the Arizona Basket Makers the average differences are 1.40 and 1.92. And furthermore, the average differences between the Old Zunis and the Arizona Basket Makers are almost no larger than those between the two groups of Basket Maker derivation. The figures are 1.50 to 1.40 for the measurements and 1.96 to 1.92 for the indices. The significance of all this material, as well as of the evidence of identity with the Pecos "Basket Makers," serves to support the previously suggested conclusion that the Old Zunis are of the Basket Maker physical type.

The fact that the Old Zunis (Hawikuh) are associated with the Basket Maker physical type makes it necessary to inquire whether or not its particular physical complex is unique in the Southwestern area. We must consider the possibility of a sole survival of Basket Maker physical type in the Zunis, in contrast to the contingency of a general distribution of this type among other Southwestern groups. In order to explore these possibilities, we have selected for comparison the Salt River (Salado) crania obtained by the Hemenway Expedition from the Los Muertos Arizona dig in 1887, a very small series of Pueblo Bonito-Chaco Can-

yon crania found by Judd, the Petrified Forest Arizona group of skulls excavated by Hough, the Chaves Pass Arizona crania found by Fewkes, and finally Hewett's Puyé New Mexico series.

All these groups are composed entirely of deformed crania. Accordingly, we have omitted the dimensions of the skull vault and have resorted entirely to the diameters and proportions of the facial skeleton, skull base, and expressions of general head size. These parts are comparatively unaffected by deformation, except infrequently in the very extreme cases. Where this occurs, the affected measurements have been eliminated from the series according to Hrdlička's designation.

It is true that the use of these several series of deformed crania cannot fail to carry with it an element of hazard. We are faced with the loss of certain pertinent measurements and proportions of the cranial vault itself, the possibility that some of the facial features might be affected by the deformation, and the question whether or not the deformed series might be in fact different from an undeformed series drawn from the same population. No truly satisfactory answers to all these considerations can be given, owing to the paucity of available data. It should be pointed out, however, that from the skeletal information available in the Southwest it would appear that no considerable changes have been affected in the facial region by the presence of deformation, except in some extreme cases. Hrdlička had arrived at a similar conclusion in which he stated in part: ⁶ "The deformed skulls, after elimination of the infrequent cases where the base and face were obviously affected by the distortion, show but little if any disturbances of the facial indices or angles, or of the size of the skull."

Furthermore, since, as we shall see, the facial and cranial base measurements and proportions of the several deformed series under study are so like those of the undeformed Zunis and Utah Basket Makers, then, if there were any basic differences, these would have to be solely in the skull vault. It is unlikely that such would be the case. To have groups virtually identical in facial and cranial base features and at the same time strongly differen-

⁶ Hrdlička, 1931, p. 92.

TABLE 8. — COMPARISON BETWEEN MEANS OF OLD ZUNI AND SALT RIVER CRANIA

MALES

MEASUREMENTS	OLD ZUNIS UNDEFORMED (35)	SALT RIVER* DEFORMED (57)	DIFF.	X P.E.
Bizygomatic diameter	134.45 ± 0.50	135.33 ± 0.63	+ 0.88	1.09
Nasion-menton height	121.90 ± 0.60	120.50 ± 0.72	- 1.40	1.49
Nasion-prosthion height	73.34 ± 0.41	74.88 ± 0.33	+ 1.54	2.91
Orbit height, right	34.75 ± 0.15	34.61 ± 0.19	- 0.14	0.56
Orbit breadth, right	38.02 ± 0.18	38.25 ± 0.15	+ 0.23	1.04
Nasal height	51.00 ± 0.27	52.75 ± 0.24	+ 1.75	4.86
Nasal breadth	25.16 ± 0.18	25.41 ± 0.13	+ 0.25	1.14
Basion-nasion length	99.48 ± 0.54	100.64 ± 1.09	+ 1.16	0.95
Basion-prosthion length	98.00 ± 0.79	98.00 ± 0.66	0.00	0.00
Palate length	54.22 ± 0.36	53.41 ± 0.25	- 0.81	1.84
Palate breadth	64.74 ± 0.38	65.09 ± 0.35	+ 0.35	0.69
Average difference .....	.....	.....	0.77	...
Cranial module	147.60 ± 0.38	152.41 ± 0.46	+ 4.71	7.98
Cranial capacity	1302.60 ± 10.90	1400.30 ± 13.40	+ 97.70	4.07
INDICES				
Total facial index	90.43 ± 0.54	88.17 ± 0.87	- 2.26	2.22
Upper facial index	54.37 ± 0.37	55.45 ± 0.35	+ 1.08	2.12
Orbital index	91.70 ± 0.43	90.83 ± 0.53	- 0.87	1.28
Nasal index	49.53 ± 0.38	48.57 ± 0.32	- 0.96	1.96
Gnathic index	98.43 ± 0.52	98.84 ± 1.32	+ 0.41	0.29
Palatal index	119.58 ± 1.03	122.26 ± 0.92	+ 2.68	1.94
Average difference .....	.....	.....	1.38	...

* Calculated from data of Hrdlička, 1931.

tiated in cranial vault form would be an unusual phenomenon, to say the least. To have it occur repeatedly in the groups we have examined is highly improbable.

Table 8 compares the measurements and indices of the Old Zuni crania with the Salt River Salado series. A study of the figures presented shows that the only statistically significant differences between the groups appear in the matter of head size, as represented by the cranial module and cranial capacity, and in the nasal height. In all the other measurements and in the indices the two groups are consistently alike. The Salt River crania have larger cranial vaults than the Old Zunis and are longer in the height of the nasal skeleton. It also appears from the comparison of the means of the nasion-menton height and nasion-prosthion height that the Zunis are shorter in the upper face height, but are greater in the height of the lower jaw. In face breadth, orbital dimensions, nasal breadth, palatal, and

cranio-facial base dimensions, the two groups are almost identical. With respect to the indices the largest differences are found for the total facial index and palatal index. The Salt River crania are shorter and wider in total facial and palatal proportions, but in no instance do their divergencies attain statistical significance. The average difference for measurements between the two groups is but 0.77 millimeters and for the indices 1.38 index units. Even though the larger skull capacity of the Salt River crania suggests larger vault dimensions than for the Old Zunis, the very strong similarity in facial, palatal, and cranio-facial base dimensions and proportions unquestionably denotes the existence of a fundamental relationship between the two groups.⁷

Our next comparison is with the Bonito-Chaco Canyon series given in table 9. The small size of this group of skulls, only eleven in number (and then not complete for all the measurements) makes it most desirable to in-

⁷ It is interesting to note in connection with the skull vault of the Salt River crania that the two undeformed males have cranial indices of 75.0 and 75.8, while the four undeformed females have cranial in-

indices of 72.6, 75.0, 77.5, and 81.1. From this scanty data it would not appear that the Salt River crania diverge very much from the Zunis in the length-breadth proportions of the skull.

TABLE 9. — COMPARISON BETWEEN MEANS OF OLD ZUNI AND BONITO-CHACO CANYON CRANIA

MALES

MEASUREMENTS	OLD ZUNIS UNDEFORMED (35)	BONITO- CHACO CANYON DEFORMED (11)	DIFF.	X P.E.
Bizygomatic diameter	134.45 ± 0.50	134.86 ± 1.30	+ 0.41	0.29
Nasion-menton height	121.90 ± 0.60	122.89 ± 1.02	+ 0.99	0.84
Nasion-prosthion height	73.34 ± 0.41	72.45 ± 0.79	- 0.89	1.00
Orbit height, right	34.75 ± 0.15	35.00 ± 0.31	+ 0.25	0.69
Orbit breadth, right	38.02 ± 0.18	38.44 ± 0.44	+ 0.42	0.89
Nasal height	51.00 ± 0.27	51.73 ± 0.68	+ 0.73	1.00
Nasal breadth	25.16 ± 0.18	25.18 ± 0.40	+ 0.02	0.04
Basion-nasion length	99.48 ± 0.54	99.88 ± 0.55	+ 0.40	0.52
Basion-prosthion length	98.00 ± 0.79	94.00 ± 0.89	- 4.00	3.36
Palate length	54.22 ± 0.36	52.29 ± 0.45	- 1.93	1.63
Palate breadth	64.74 ± 0.38	64.16 ± 0.25	- 0.58	1.29
Height of symphysis	36.53 ± 0.33	35.78 ± 0.39	- 0.75	1.44
Average difference .....	.....	.....	0.95	...
Cranial module	147.60 ± 0.38	152.00 ± 0.92	+ 4.40	4.44
Cranial capacity	1302.60 ± 10.90	1357.70 ± 31.70	+ 55.10	1.64
INDICES				
Total facial index	90.43 ± 0.54	90.60 ± 1.34	+ 0.17	0.18
Upper facial index	54.37 ± 0.37	53.43 ± 0.61	- 0.94	1.32
Orbital index	91.70 ± 0.43	91.86 ± 0.60	+ 0.16	0.22
Nasal index	49.53 ± 0.38	48.64 ± 0.69	- 0.89	1.13
Gnathic index	98.43 ± 0.52	94.12 ± 0.79	- 4.31	4.59
Palatal index	119.58 ± 1.03	122.71 ± 1.24	+ 3.13	1.94
Average difference .....	.....	.....	1.60	...

* Calculated from data of Hrdlička, 1931.

interpret these data with considerable reservation. If we glance over the table of measures, we find the very closest of similarity between the two groups in ten out of twelve measurements. The only two statistically significant differences appear in the shorter basion-prosthion length (4.00 mm.) and the shorter palate length (1.93 mm.) of the Bonito-Chaco crania. The Old Zunis are somewhat smaller in the matter of gross head size, but to what extent is very difficult to judge. In indices, the Old Zunis are practically identical with the Chaco series in total facial index, upper facial, orbital, and nasal indices. The gnathic and palatal indices show large differences between the means, owing to the shortened palate and basion-prosthion lengths. The Chaco crania are significantly less prognathous than the Old Zunis and more brachyuranic, but in this latter case the difference is not statistically significant. The average difference between the means of the measurements is 0.95 and between the indices 1.60.

What is most remarkable is that so small a series of crania as the Bonito-Chaco Canyon group should show virtual identity with the Old Zunis in ten out of twelve measurements and four out of six indices. We cannot interpret this similarity between the two groups as merely fortuitous, but rather accept the evidence that there is a fundamental physical relationship between them, even though this inference is based on such a limited series.

Table 10 compares the means of the measurements and indices of the Old Zunis with the Petrified Forest crania of Arizona. There can be no doubt here of strong physical similarity between the two groups. The only significant difference in measurements is in palate breadth, with the Petrified Forest series 2.43 millimeters broader than the Zunis. The indices are all very much alike, with no difference statistically significant. The average divergency for measurements is only 0.81 and for the indices 0.80. In the matter of head size the Petrified Forest crania are distinctly larger

TABLE 10. — COMPARISON BETWEEN MEANS OF OLD ZUNI AND PETRIFIED FOREST CRANIA

MALES		OLD ZUNIS UNDEFORMED (35)	PETRIFIED* FOREST DEFORMED (13)	DIFF.	X P.E.
MEASUREMENTS					
Bizygomatic diameter	.....	134.45 ± 0.50	134.38 ± 0.61	—0.07	0.09
Nasion-menton height	.....	121.90 ± 0.60	121.80 ± 1.10	—0.10	0.08
Nasion-prosthion height	.....	73.34 ± 0.41	73.92 ± 0.62	+ 0.58	0.78
Orbit height, right	.....	34.75 ± 0.15	35.05 ± 0.35	+0.30	0.81
Orbit breadth, right	.....	38.02 ± 0.18	37.80 ± 0.27	—0.22	0.69
Nasal height	.....	51.00 ± 0.27	51.84 ± 0.39	+0.84	1.79
Nasal breadth	.....	25.16 ± 0.18	24.87 ± 0.31	—0.29	0.81
Basion-nasion length	.....	99.48 ± 0.54	100.89 ± 0.48	+1.41	1.96
Basion-prosthion length	.....	98.00 ± 0.79	99.62 ± 0.86	+1.62	1.38
Palate length	.....	54.22 ± 0.36	55.33 ± 0.42	+1.11	1.98
Palate breadth	.....	64.74 ± 0.38	67.17 ± 0.53	+2.43	3.74
Height of symphysis	.....	36.53 ± 0.33	35.73 ± 0.37	—0.80	1.60
Average difference	.....	.....	.....	0.81	...
Cranial module	.....	147.60 ± 0.38	149.91 ± 0.78	+2.31	2.66
Cranial capacity	.....	1302.60 ± 10.90	1408.20 ± 24.59	+105.60	3.93
INDICES					
Total facial index	.....	90.43 ± 0.54	90.00 ± 1.16	—0.43	0.34
Upper facial index	.....	54.37 ± 0.37	54.38 ± 0.73	+0.01	0.01
Orbital index	.....	91.70 ± 0.43	92.90 ± 1.39	+1.20	0.83
Nasal index	.....	49.53 ± 0.38	48.00 ± 0.79	—1.53	1.64
Gnathic index	.....	98.43 ± 0.52	98.12 ± 0.90	—0.31	0.30
Palatal index	.....	119.58 ± 1.03	121.50 ± 0.80	+1.92	1.40
Average difference	.....	.....	.....	0.80	...

* Calculated from data of Hrdlička, 1931.

than the Old Zunis and should suggest the possession of larger cranial diameters. Regardless of this fact, the appearance of such a large number of similarities in the other dimensions and proportions of the crania suggests that the Old Zunis and the Petrified Forest Indians may be of the same physical type.

In the comparison between the Old Zunis and the Chaves Pass crania, presented in table 11, we see no significant differences between their series, except in the case of the cranial module and cranial capacity. The Chaves Pass crania are unquestionably larger-headed than those of the Old Zuni, even when allowances are made for size and variability of the samples. The average differences between the means is but 0.83 for measurements and only 0.94 for indices. And again we are faced with the conclusion that the Old Zunis and the Chaves Pass crania have distinct resemblances.

Table 12 gives the means of the measurements and indices of the Puyé New Mexico crania in contrast to those of the Old Zunis. If we consider the measurements first, we find

that although the two groups display numerous similarities in a large number of features, significant differences are apparent in the shorter face height of the Puyé series, in the smaller nose breadth, and in the shorter height of the lower jaw. In all the measurements with the exception of the breadth of the orbits, the Puyé series shows smaller mean dimensions. In head size the Puyé crania are slightly larger than the Zunis, but not significantly so. There are no statistically significant differences with respect to the indices. The average differences for measurements is 1.29 and for indices 1.25. The Puyé series is physically more differentiated from the Old Zunis than the other groups we have considered. Nevertheless, there still remains sufficient similarity between them to be indicative of racial affinity. It is quite possible that the Puyé were originally closer to the general Zuni type, but were modified by the absorption of new elements in the population which resulted in smaller facial dimensions and larger cranial proportions. This shortening of the facial dimensions is particu-

TABLE 11. — COMPARISON BETWEEN MEANS OF OLD ZUNI AND CHAVES PASS CRANIA

MALES

MEASUREMENTS	OLD ZUNIS UNDEFORMED (35)	CHAVES PASS * DEFORMED (18)	DIFF.	X P.E.
Bizygomatic diameter	134.45 ± 0.50	133.83 ± 0.89	— 0.62	0.61
Nasion-prosthion height	73.34 ± 0.41	74.36 ± 0.65	+ 1.02	1.32
Orbit height, right	34.75 ± 0.15	35.25 ± 0.29	+ 0.50	1.56
Orbit breadth, right	38.02 ± 0.18	38.59 ± 0.29	+ 0.57	1.73
Nasal height	51.00 ± 0.27	51.37 ± 0.26	+ 0.37	1.00
Nasal breadth	25.16 ± 0.18	24.34 ± 0.28	— 0.82	2.48
Basion-nasion length	99.48 ± 0.54	101.56 ± 0.80	+ 2.08	2.17
Basion-prosthion length	98.00 ± 0.79	99.00 ± 0.69	+ 1.00	0.95
Palate length	54.22 ± 0.36	55.20 ± 0.48	+ 0.98	1.63
Palate breadth	64.74 ± 0.38	65.10 ± 0.36	+ 0.36	0.69
Average difference .....	.....	.....	0.83	...
Cranial module	147.60 ± 0.38	151.40 ± 0.73	+ 3.80	4.63
Cranial capacity	1302.60 ± 10.90	1429.04 ± 19.04	+ 126.44	5.76
INDICES				
Upper facial index	54.37 ± 0.37	55.00 ± 0.62	+ 0.63	0.88
Orbital index	91.70 ± 0.43	91.50 ± 0.99	— 0.20	0.19
Nasal index	49.53 ± 0.38	47.38 ± 0.66	— 2.15	2.83
Gnathic index	98.43 ± 0.52	98.67 ± 0.53	+ 0.24	0.32
Palatal index	119.58 ± 1.03	118.10 ± 0.95	— 1.48	1.06
Average difference .....	.....	.....	0.94	...

* Calculated from data of Hrdlička, 1931.

larly conspicuous in the height measurements and is very characteristic of groups in the Rio Grande region, as we shall see later.

The results of our individual comparisons show conclusively that the Old Zuni physical type was not unique in the Southwestern area, but was on the contrary largely distributed over parts of Arizona and Northern and Western New Mexico. Disregarding for the present the question of the chronological relationships of the various groups, it can be seen that all of them — the Zunis, the Salt River, Chaco, Petrified Forest, Chaves Pass, and to a lesser extent the Puyé — represent on the whole a unified physical type.⁸ A brief analysis of the different measurements will serve to emphasize the truth of this assertion.

If we omit the Puyé series, for the moment, in bizygomatic diameter the means of the groups under consideration all fall within the narrow range of 133.83 to 135.33, in nasion-menton height the means run from 120.50 to 122.89, and for nasion-prosthion height, from

72.45 to 74.88. Similarly small range variations in means are to be found for orbital height, orbital breadth, nasal height, and nasal breadth. In nasion-basion length the mean for the Zunis is 98.00 millimeters and for the other groups the range is from 99.88 to 101.56. With respect to the basion-prosthion length the Chaco series is distinctly smaller, while all the other means fall within a restricted range. In palate length and in the height of the lower jaw all the means congregate within limited ranges, but in the case of the breadth of the palate the larger mean of the Petrified Forest crania destroys the otherwise consistent size of this measurement. In regard to the question of head size, as indicated by the cranial module and cranial capacity, the Zunis and the Chaco series are smaller than the Salt River, Petrified Forest, and Chaves Pass groups. If we turn to the indices, we find small mean distributions for virtually every proportion listed. The mean for the total facial index varies from 88.17 to 90.60, the upper facial index from 53.43 to 55.45, the orbital index from 90.83 to

⁸ Hrdlička in his *Catalogue of Human Crania*, p. 91, had already pointed out the close relation between

Utah Basket Makers and the Salt River Valley and Old Zuni groups.

TABLE 12. — COMPARISON BETWEEN MEANS OF OLD ZUNI AND PUYÉ CRANIA

MALES

MEASUREMENTS	OLD ZUNIS UNDEFORMED (35)	PUYÉ * DEFORMED (17)	DIFF.	X P.E.
Basion-bregma height	133.53 ± 0.46	133.29 ± 1.22	— 0.24	0.18
Bizygomatic diameter	134.45 ± 0.50	134.00 ± 0.71	— 0.45	0.52
Nasion-menton height	121.90 ± 0.60	118.08 ± 0.87	— 3.82	3.60
Nasion-prosthion height	73.34 ± 0.41	72.00 ± 0.69	— 1.34	1.54
Orbit height, right	34.75 ± 0.15	34.24 ± 0.24	— 0.51	1.76
Orbit breadth, right	38.02 ± 0.18	38.28 ± 0.34	+ 0.26	0.67
Nasal height	51.00 ± 0.27	49.71 ± 0.45	— 1.29	2.48
Nasal breadth	25.16 ± 0.18	24.12 ± 0.23	— 1.04	3.59
Basion-nasion length	99.48 ± 0.54	97.46 ± 0.54	— 2.02	2.66
Basion-prosthion length	98.00 ± 0.79	96.18 ± 0.93	— 1.82	1.49
Palate length	54.22 ± 0.36	53.36 ± 0.34	— 0.86	1.32
Palate breadth	64.74 ± 0.38	63.55 ± 0.62	— 1.19	1.65
Height of symphysis	36.53 ± 0.33	34.54 ± 0.49	— 1.99	3.37
Average difference .....	.....	.....	1.29	...
Cranial module	147.60 ± 0.38	148.53 ± 0.79	+ 0.93	1.07
Cranial capacity	1302.60 ± 10.90	1343.10 ± 22.00	+ 41.50	1.69
INDICES				
Total facial index	90.43 ± 0.54	88.43 ± 1.28	— 2.00	1.44
Upper facial index	54.37 ± 0.37	52.25 ± 0.77	— 2.12	2.49
Orbital index	91.70 ± 0.43	90.00 ± 0.59	— 1.70	2.33
Nasal index	49.53 ± 0.38	48.71 ± 0.48	— 0.82	1.43
Gnathic index	98.43 ± 0.52	98.91 ± 0.81	+ 0.48	0.50
Palatal index	119.58 ± 1.03	119.22 ± 1.44	— 0.36	0.20
Average difference .....	.....	.....	1.25	...

* Calculated from data of Hrdlička, 1931.

92.90, etc. And, in the case of the gnathic index, apart from the lower mean of the Chaco series, the means for this proportion range from 98.12 to 98.84.

If, as we have maintained, the Zunis are essentially of the same physical type as the Basket Maker series, then the Southeastern Utah group should also display a fundamental conformity with this unified group of Southwestern crania. In order to test the validity of this contingency, in tables 13 and 14 we have compared the means of the measurements and indices of the Utah Basket Makers with those of the five series of Southwestern crania and listed the differences between the means and the resultant x p.e.'s.

If we consider the measurements first, we find that on the whole the Utah Basket Maker series shows very striking similarities with all the groups. The average differences between the means of the Utah crania and the Salt River series is only 0.86, with the Bonito-Chaco Canyon group 0.95, with the Petrified Forest 0.75, with the Chaves Pass 1.09, and with the Puyé

crania 1.29. A detailed examination of the individual measurements shows that in only a very few instances are the differences between the Basket Maker means and those of the Southwestern crania statistically significant. There are no significant divergencies in bizygomatic diameter, in nasion-menton height, nasion-prosthion height, orbit height, and in orbit breadth. In nasal height the mean of the Salt River series is significantly higher and that of the Puyé group significantly lower. In nasal breadth, only the Puyé series shows a significantly lower mean. The Petrified Forest and Chaves Pass crania are significantly greater in basion-nasion length, but in respect to the basion-prosthion length no significant variations are to be found. The palate is significantly narrower in the Bonito and Puyé groups, while the height of the mandibular symphysis shows no significant differences. Finally, in reference to the question of gross head size, as illustrated by the cranial module and cranial capacity, all the groups but the Petrified Forest and Puyé series are significant-

TABLE 13. — COMPARISON BETWEEN MEANS OF SOUTHEASTERN UTAH BASKET MAKERS AND OTHER SOUTHWESTERN CRANIA

MALES

MEASUREMENTS	UTAH BASKET MAKERS (41)	SALT RIVER (57)	BONITO- CHACO CANYON (11)	PETRIFIED FOREST (13)	CHAVES PASS (18)	PUEYÉ (17)
Basion-bregma height	133.27±0.44	.....	.....	.....	.....	133.29
Bizygomatic diameter	134.78±0.50	135.33	134.86	134.38	133.83	134.00
Nasion-menton height	121.10±1.02	120.50	122.89	121.80	.....	118.08
Nasion-prosthion height	73.79±0.50	74.88	72.45	73.92	74.36	72.00
Orbit height, right	34.75±0.14	34.61	35.00	35.05	35.25	34.24
Orbit breadth, right	37.98±0.14	38.25	38.44	37.80	38.59	38.28
Nasal height	51.37±0.30	52.75	51.73	51.84	51.37	49.71
Nasal breadth	25.24±0.13	25.41	25.18	24.87	24.34	24.12
Basion-nasion length	98.88±0.40	100.64	99.88	100.89	101.56	97.46
Basion-prosthion length	96.72±0.54	98.00	94.00	99.62	99.00	96.18
Palate breadth	66.48±0.40	65.09	64.16	67.17	65.10	63.55
Height of symphysis	35.88±0.44	.....	35.78	35.73	.....	34.54
Cranial module	148.67±0.30	152.41	152.00	149.91	151.40	148.53
Cranial capacity	1339.00±9.21	1400.30	1357.70	1408.20	1429.04	1343.10
INDICES						
Total facial index	89.48±0.67	88.17	90.60	90.00	.....	88.43
Upper facial index	54.75±0.37	55.45	53.43	54.38	55.00	52.25
Orbital index	91.33±0.42	90.83	91.86	92.90	91.50	90.00
Nasal index	49.35±0.32	48.57	48.64	48.00	47.38	48.71
Gnathic index	97.69±0.39	98.84	94.12	98.12	98.67	98.91

TABLE 14. — DIFFERENCES BETWEEN MEANS OF SOUTHEASTERN UTAH BASKET MAKERS AND OTHER SOUTHWESTERN CRANIA

MALES

MEASUREMENTS	UTAH BASKET MAKERS (41)	SALT RIVER (57)	BONITO- CHACO CANYON (11)	PETRIFIED FOREST (13)	CHAVES PASS (18)	PUEYÉ (17)
	MEAN	DIFF. X P.E.	DIFF. X P.E.	DIFF. X P.E.	DIFF. X P.E.	DIFF. X P.E.
Basion-bregma height	133.27	.....	.....	.....	.....	+ 0.02 0.01
Bizygomatic diameter	134.78	+ 0.55 0.68	+ 0.08 0.06	- 0.40 0.51	- 0.95 0.93	- 0.78 0.90
Nasion-menton height	121.10	- 0.60 0.48	+ 1.79 1.24	+ 0.70 0.63	.....	3.02 2.25
Nasion-prosthion height	73.79	+ 1.09 1.82	- 1.34 1.44	+ 0.13 0.16	+ 0.47 0.57	- 1.79 2.11
Orbit height, right	34.75	- 0.14 0.56	+ 0.25 0.71	+ 0.30 0.81	+ 0.50 1.56	- 0.51 1.82
Orbit breadth, right	37.98	+ 0.27 1.35	+ 0.46 1.00	- 0.18 0.60	+ 0.61 1.91	+ 0.30 0.81
Nasal height	51.37	+ 1.38 3.54	+ 0.34 0.46	+ 0.47 0.96	0.00 0.00	- 1.66 3.08
Nasal breadth	25.24	+ 0.17 0.85	- 0.06 0.14	- 0.37 1.06	- 0.90 2.81	- 1.12 4.15
Basion-nasion length	98.88	+ 1.76 1.52	+ 1.00 1.47	+ 2.01 3.19	+ 2.68 3.01	1.42 2.12
Basion-prosthion length	96.72	+ 1.28 1.51	- 2.72 2.62	+ 2.90 2.87	+ 2.28 2.59	0.54 0.50
Palate breadth	66.48	- 1.39 2.62	- 2.32 4.94	+ 0.69 1.04	- 1.38 2.56	- 2.93 4.01
Height of symphysis	35.88	.....	- 0.10 0.17	- 0.14 0.25	.....	1.34 2.03
Average difference .....	.....	0.86	0.95	0.75	1.09	1.29
Cranial module	148.67	+ 3.74 6.80	+ 3.33 3.43	+ 1.24 2.55	+ 2.73 3.46	- 0.14 0.17
Cranial capacity	1339.00	+61.30 3.83	+18.70 0.57	+69.20 2.61	+90.04 4.26	+ 4.10 0.17
INDICES						
Total facial index	89.48	- 1.31 1.19	+ 1.12 0.75	+ 0.52 0.39	.....	- 0.95 0.66
Upper facial	54.75	+ 0.70 1.32	- 1.32 1.86	+ 0.40 0.49	+ 0.25 0.35	- 2.50 2.91
Orbital index	91.33	- 0.50 0.74	+ 0.53 0.73	+ 1.57 1.08	- 0.17 0.16	- 1.33 1.82
Nasal index	49.35	- 0.78 1.73	- 0.71 0.93	- 1.35 1.59	- 1.97 2.70	- 0.64 1.12
Gnathic index	97.69	+ 1.15 0.84	- 3.57 4.06	+ 0.43 0.44	+ 0.98 1.48	+ 1.22 1.36
Average difference .....	.....	0.89	1.45	0.85	0.84	1.33

ly larger than the Basket Makers. In the indices, we encounter even fewer differences than was apparent in the case of the measurements. Only one significant difference could be found out of twenty-four mean comparisons. The average difference between the means of the Utah Basket Maker indices and those of the Salt River crania is 0.89, the Bonito

* AUTHOR'S NOTE. It is recognized that the use of x p.e.'s for the estimation of significance of mean differences in the case of such small series as the Petrified Forest, Bonito-Chaco Canyon, and Pecos "Basket Makers," leaves much to be desired as a strict statistical procedure. For this reason the accuracy of the results has been checked by the utilization of

group 1.45, the Petrified Forest series 0.85, and the Chaves Pass and Puyé collections 0.84 and 1.33, respectively. Thus we can conclude that the several Southwestern skeletal series, as well as the Zunis, have a strong physical bond with the Southeastern Utah Basket Makers and as such must have been derived from the same or similarly constituted stock.*

Fisher's *t*-test for small samples. No essential modifications in the assessment of the comparisons of the groups were necessary in consequence of the application of this additional statistical procedure. Accordingly, the x p.e. computations have been retained to preserve the consistency of the original tabular material.

TIME RELATIONSHIPS OF "SOUTHWEST PLATEAU" INDIANS

THE fundamental unity in physical type as recognized for the Old Hawikuh Zunis, the Utah Basket Makers, and in the other groups of Southwestern crania suggests the possibility that all these groups were derived from a single racial stock. Or at the very least, they must be recognized as being representatives of intimately related strains. In order that we may conveniently refer to these groups and because of their singular importance, we have designated these people as the "Southwest Plateau" Indians. The choice of a *geographical name* for this physical type has been made intentionally. Our purpose is to avoid the confusion that developed in the work of the Southwestern archaeologists with their manifold cultural classifications.¹ The term "Southwest Plateau" Indians does not carry with it any implication of time or of culture but refers solely to a racial stock which occupied the plateau area of "the San Juan, the Rio Grande, the Upper Gila and Salt, the Little Colorado, most of Utah, and a portion of east Nevada."

What are the time relationships of the units forming this "Southwest Plateau" stock? Are they all of the same date, or are there some groups definitely older than others? How far back can we trace this physical stock and can we form a tentative theory of its historical development and distribution?

Any attempts to answer these questions must take into consideration the archaeological-culture classifications accepted by students of Southwest archaeology. It has been established that the culture sequences in the upland plateau regions of the Southwest fall into two major divisions, Basket Maker and Pueblo. The Basket Maker culture is universally recog-

nized as being older and its period of development has been shown to have preceded the Pueblo stages in all parts of the territory. Because each one of the series of skeletons is associated with archaeological material, each can be assigned to one of these two time intervals or horizons. The Southeastern Utah Grand Gulch Rockshelters crania² belong to the Basket Maker period. The reports of the discoverers and investigators of the sites from which this important collection was obtained leaves little doubt but that this group is predominantly of Basket Maker origin. Hooton's Northeastern Arizona Basket Maker series also belongs here as these crania have been identified without exception as authentic Basket Makers and post-Basket Makers by Kidder and Guernsey.³

The other groups of crania all fall into the Pueblo period. The Chaco-Bonito series is definitely attributable to the classic era of the Pueblos called the "Great Pueblo" period (Pueblo III). Of the eleven crania composing this group, eight came from Pueblo Bonito itself and the remaining three from other sites in the Chaco Canyon. The Chaves Pass remains were excavated by Fewkes from a Pueblo site in Northeastern Arizona. From examination of his report of the ruins and the associated artifacts and pottery these skeletons may be assigned to the early part of the "Regressive Pueblo" period (Pueblo IV).⁴ The Petrified Forest series came from cemeteries allied to the Stone Axe and Canyon Butte ruins near Holbrook, Arizona. These from consideration of Hough's description of the archaeological finds must also be regarded as belonging to the "Regressive Pueblo" period (Pueblo IV).⁵ A similar period designation may be

Plateau" stock. This fact is apparent in spite of the small size of the group and their relative heterogeneity; for the results of the previous comparisons of the Arizona Basket Makers with the Old Zunis and the Utah series illustrate a fundamental similarity between them.

¹ Fewkes, 1898.

² Hough, 1903.

¹ For discussions of nomenclature difficulties in Southwestern archaeology, and attempts at their remedy and simplification, see Kidder, 1924 and 1927; Gladwin, 1934; and Roberts, 1935 and 1937b.

² Prudden, 1903. Pepper, 1902.

³ Kidder and Guernsey, 1921. The distinctive physical characteristics of the Arizona Basket Makers readily mark them off as members of the "Southwest

applied to the skeletons recovered from the Puyé cliff-village excavations on the Pajarito Plateau in New Mexico.⁶

In dating the Salt River Valley series we meet with a very interesting and complex set of circumstances. There is no difficulty in dating the skeletons themselves for they have been ascribed to the early part of the "Regressive Pueblo" period (Pueblo IV).⁷ But the other conditions are quite unusual and have important considerations from our point of view. The site from which these remains were excavated by the Hemenway Expedition in the latter part of the nineteenth century was called Los Muertos and is located in the Salt River Valley of Arizona. This is not in the upland plateau regions but in the northern margin of the desert province. It is the only group of crania of "Southwest Plateau" stock found outside of the upland area. The task of examining the archaeological data fell to Dr. E. W. Haury who has shown in a splendid monograph that Los Muertos was simultaneously occupied by two peoples, the Hohokam and the Pueblos. The former probably cremated their dead in urns, whereas the latter practised inhumation and on this account the present crania were obtained. The period of co-residency was apparently one of comparatively short duration, the immigrant Pueblos (specifically referred to as the Salado peoples) after a stay of about one hundred and fifty years withdrew from the area, leaving the native Hohokam still resident. By comparative studies of dated sites with associated cultures, Haury places the Salado invasion at about 1300 A.D. (possibly earlier), and the "permanent abandonment of Los Muertos, Casa Grande and the allied ruins as around 1400, certainly not later than 1450." The cause for the invading movements he attributes in part to the severe drought which struck a large part of the Southwest in the last quarter of the 1200's, and also to the pressure of the new peoples in the Northern Arizona and Colorado regions. The result was, he contends, that the cliff-dwellings of that area were abandoned and the people migrated south, exerting pressure on the inhabitants of the Little Colorado region. The latter were forced southward into the desert

regions and "as part of this expansion, the Salado people . . . moved into the Gila Basin. They formed only the leading edge of a huge tidal wave of Pueblo peoples sweeping south, and it was only this vanguard of Salado people that reached the Gila Basin to share that area with the Hohokam." The somatological complex of the Salt River Valley skeletons leaves little doubt that they are "Southwest Plateau" Indians, and in consequence it is interesting to note that their alliance to the peoples of the northern plateau area was established without the corroborative evidence of the archaeological data.

The last group of crania to be dated is the Old Hawikuh Zuni series. The extensive Hawikuh site from which this collection was obtained was excavated by Hodge, who found characteristically Puebloan houses, kivas, objects, pottery, etc.⁸ His published data indicates that Old Hawikuh was occupied in the Pueblo IV period and extended into historic times (early Pueblo V). Founded at least two centuries before the arrival of the Spanish Conquistadores, Hawikuh was continuously occupied until its abandonment in 1670. From information supplied by Hodge, it appears that most of the skeletal material recovered from these excavations belonged to post-Spanish times, a period which we have conveniently referred to as Early Spanish.

The whole problem of dating would not be complete, if we did not consider such chronological data as are available through the development of the science of dendrochronology. The tree-ring dating system, so skillfully adapted for study in the Southwest by Dr. A. E. Douglass of the University of Arizona, has made it possible to give absolute dates for building construction at various archaeological sites. As such they may be used to give a close approximation of the age of the founding of the site and often its probable period of occupancy. Below we have listed the series of sites associated with the "Southwest Plateau" stock whose tree-ring dates have already been determined. It must be remembered that these dates are not necessarily the first building dates of the sites, nor are they indicative of the complete term of occupancy. They are simply the

⁶ Hewett, 1906.

⁷ Haury, 1944.

⁸ Hodge, 1937.

dates at which the roof-beams were cut. The reason for including the Pecos Pueblo dates will be considered at a later stage of the discussion.

Pueblo Bonito	919 to 1130	(Douglass, 1935)
Pecos Pueblo	1348 to 1612	(Stallings, 1933)
Hawikuh	1381 ⁹	(Douglass, 1935)
Chaves Pass	1381	(Douglass, 1935)
Puyé	1507 to 1565 $\pm$ 3	(Stallings, 1933)

The skeletal material we have examined, being related to the sites listed, must then be referable to the dated periods as given above.

As a result of this study of the time relationships of the units forming the "Southwest Plateau" stock, several vital conclusions become self-evident. Of major importance is the fact that there appears to have been in the upland area *a continuity of "Southwest Plateau" stock from the Basket Maker period clear up to recent times*. Up to the present, there is no evidence to show that there was *any other physical stock on the same level of importance as the "Southwest Plateau" Indians in the make-up of the Basket Maker-Pueblo peoples*. The presence of other physical types and deviations from the typical "Southwest Plateau" pattern among the Pueblos and especially the later Pueblos are explainable for the most part as modifications of the original strain due to the absorption of new blood through intermittent small contacts with other groups, intermarriage, etc. It is also possible that certain of these changes in physical type may be the result of stimuli persistently present in the environment or of selective genetic factors. There is no suggestion of any sweeping change in physical type or of any enormous influx of new blood into the Basket Maker-Pueblo peoples, until perhaps the latter part of the Pueblo IV period, except in the Rio Grande region. At that time in the Rio Grande region more extensive physical modifications occurred in Pueblo IV times in particular. Heretofore

attention has been called to changes in the skull vault, especially to the change in the cranial index. To the slow changes already mentioned were added others doubtless of slight consequence until Pueblo IV and Pueblo V time when the contact with the Spaniards, Navahos, Apaches, and other groups from the North and East obliterated the original "Southwest Plateau" type except where extreme hostility and isolation prevented it.

We have representatives of the "Southwest Plateau" stock in the Basket Maker period and the "Great Pueblo" period (Pueblo III), but our historical sequence shows a gap for the "Developmental Pueblo" period (Pueblo I and II). This is not because the stock did not persist but is due to the lack of suitable numbers of Pueblo I and II skeletons from which we may draw comparisons. In the opinion of the writer, it is a reasonable probability that when such data are made available, the physical type will be of the general "Southwest Plateau" pattern.¹⁰ There is no reason for assuming any radical change in physical type at the end of the Basket Maker period. The supposedly sudden appearance of large numbers of deformed crania in the pre-Pueblo and the very earliest of Pueblo phases has caused the majority of archaeologists to believe that these deformed specimens marked the arrival of what they termed "a new race," "a round-headed invasion." The writer cannot be of the same opinion. Granted that changes in the cranial index were associated with the wholesale introduction of occipital flattening and deformation, the lack of concomitant modifications in the other features of the skull prevent our assuming a *wholesale arrival* of new peoples. Until data are presented showing large alterations in facial or skeletal features at the time of the introduction of deformation, the writer is prone to believe that the deformed crania are more the expression of a change in fashion or ideals of beauty rather than in physical type.

⁹ It is doubtful whether this is one of the early dates for Hawikuh, for Hodge in a personal communication says that Douglass tentatively gives the date of a kiva beam at about the middle of the thirteenth century.

¹⁰ Since the time when this was written (1935) and the abstract covering this material was read and published (1936), confirmation of this prediction has appeared in a publication by Dr. T. Dale Stewart. As a

result of a study of a small series of skeletal remains from the Whitewater District, Eastern Arizona, which for the most part has been assigned to the "Developmental Pueblo" period (Pueblo I and II), Stewart concludes that "... further elaboration is given Seltzer's view that the evidence does not justify the theory of a sweeping change in physical type during the transitional Basket Maker-Pueblo period." Stewart, 1940, p. 161.

In this connection it is interesting to note that cranial deformation was not limited solely to the Pueblo periods. There are data to show that a certain amount of occipital flattening was present even in the Basket Maker period. Hrdlička records in his Southeastern Utah Rockshelters series, four cases of occipital compression (out of forty-two) in the males, and also four crania with occipital deformation (out of twenty-six) in the females.¹¹

Additional pertinent observations must be made before we proceed to other considerations. There is no doubt that on the whole there has been too much emphasis placed on the cranial index in the interpretation of Southwest skeletal material. This does not imply that head form is to be considered unimportant or that it should be relegated to a minor position in the total physical complex. On the contrary, head form is an important but not the sole criterion of race. In respect to the racial problems of the Southwest, general head size, the dimensions and proportions of the nose and face are of at least equal significance with the cranial index. For purposes of racial diagnosis it is significant and desirable that use be made of a combination of number of physical features rather than to place reliance on a single characteristic.

The loose use by anthropologists of such terms as longheads and roundheads, dolichos and brachys, without citing the values of the cranial or cephalic indices is gross carelessness. The Basket Makers have been described by almost everyone as dolichocephals or longheads, and the Pueblos have been called brachycephals or roundheads. The impression conveyed by these statements is that all Basket Maker crania are dolichocephalic, that is, have indices below 75, and that all the Pueblo crania are brachycephalic with indices over 80. This is not true. For, in the Basket Maker series from Grand Gulch Utah, 30.9 per cent of the males (out of thirty-three) and 50 per cent of the females (out of twenty) have cranial indices over 75. The range in index runs up to 79.4 in the males and 80.8 in the females. In the Arizona Basket Maker group, 46.7 per cent of the males have indices over 75, and the most

roundheaded individual of this lot has an index of 83.91. Accordingly, it is obvious that much of the Basket Maker population is not dolichocephalic at all, even though the mean cranial indices of two series of crania fall into the dolichocephalic range.

If we consider the Pueblos, we find the same misstatements and the same abuse of the terminology of physical anthropology. The Pueblo people were not and are not as brachycephalic as the authors of published reports would have us believe. The two largest undeformed cranial groups that can be used for determining the cranial index are the Old Hawikuh Zunis and Hooton's Pecos Total Series A.¹² If we sort out all the individuals who are not brachycephalic, that is, with indices below 80, we find that out of thirty-five male Zunis, twenty-nine or 85.29 per cent have cranial indices below 80, and that out of forty-three male Pecos crania, twenty-five or 58.14 per cent also have cranial indices below 80. The mean cranial index for the undeformed Zuni series is 75.91 which can be considered a very low mesocephalic, almost a dolichocephalic index. The mean cranial index for the Pecos Total Series A is 78.30, a middle mesocephalic mean. From these data there can be no doubt the Pueblo people as represented by these crania were more mesocephalic than brachycephalic.

There is additional evidence to show that the Pueblo Indians were not as brachycephalic as has been supposed. In 1935 Hrdlička published the average cephalic indices of a number of groups of Pueblo Indians having undeformed heads.¹³ His cephalic indices of the males are as follows: Taos 78.2, Sia 78.5, Domingo 79.6, San Juan 80.2, Jemez 80.3, Laguna 80.3, Acoma 81.2, Isleta 81.2, Hano 81.4, Zuni 81.8, and Hopi 83.0. Since by definition a brachycephalic index on the living is 82 or above, then the Hopi group is the only one which qualifies for a classification as brachycephalic. All the other groups have mesocephalic indices. Assuming that there are just as many individuals below the mean as above, then it may be said that these averages signify that the presence of the mesocephalic element is larger

¹¹ Hrdlička, 1931, pp. 78 and 82. Crania showing deformation as observed by Hrdlička in the Southeastern Utah Rock shelters series are males, catalogue

numbers 1013, 55, 138, 1012; and for females numbers 8, d, b, and 100.

¹² Hooton, 1930.

¹³ Hrdlička, 1935.

in almost all these groups than the brachycephalic element. On these data the Pueblo people should be referred to as mixed "mesocephalic and brachycephalic peoples." If it were necessary to refer to them by a single term, then it would still be more accurate to call them mesocephals than brachycephals. However, there is reason to believe that if studies were made in these villages today (more than thirty years later), the mean cephalic indices might well fall into the brachycephalic classification. This is true at Zuni where a significant increase in the cephalic index from mesocephaly to brachycephaly took place in the period of 1900 to 1933.

In previous statements in reference to the physical changes in the plateau population at the time of the transition from the Basket Maker to the Pueblo period, we did not imply that there were no arrivals of new peoples at all. What is emphasized is that there was no tidal wave of new peoples resulting in virtual

submergence of the old and original stock. Some small brachycephalic and mesocephalic elements were already present in the upland area in the latter part of the Basket Maker period and it is reasonable to believe that additional mesocephalic and brachycephalic strains continued to arrive all through the Pueblo era. But since no radical modifications (apart from those mentioned with regard to the skull vault) can be detected in the "Classic" and the early "Regressive Pueblo" periods, except in the Rio Grande, then such new elements must have been in the form of *small accretions* which were in many cases easily absorbed in the original population. When as for example in the Rio Grande area the new elements arrived earlier and became more and more numerous, their addition to the population was marked by attendant changes in the dimensions of the face and nose, head size, and stature, as well as in the shape of the cranial vault.

THE RIO GRANDE AREA

THERE is reason to believe, if a comprehensive study were made of the physical status of the living Pueblo Indians in the Rio Grande region, that relatively little of the very early Puebloan complex would still be visible in the composition of the existing populations. Rather than give determinate information relative to the original elements in the groups, such a study would serve more as a descriptive analysis of the newer alien strains which have invaded this region. This situation is due to the fact that of all the districts of the upland plateau, the Rio Grande area has been the scene of the most extensive intrusive influences. On the Indian side there is beginning to accumulate suggestive evidence that many tribes from the northeastern and eastern plains were active over a long period of time in mixing their blood with that of the original inhabitants. In addition, from the very earliest period of white contact, the Rio Grande region had been the focus of Spanish operations, and, when the American rule succeeded that of the Spaniards, the same locale was selected for concentrations of populations. There is little doubt, as can be seen from historical records of white admixture, that the Spaniards and Mexicans and to a lesser extent the Americans all exerted considerable effect upon the physical constitution of the Rio Grande Puebloans. The result is today the Indians of this region are a complex heterogeneous group, their earlier elements having been considerably diluted and replaced by many other strains.

An estimate of the nature of the physical complex of the Rio Grande Puebloans in prehistoric and early historic times may be obtained from Hooton's analysis of the skeletons of Pecos Pueblo.¹ The fact that Pecos Pueblo is not situated on the plateau and hence is not strictly in the Rio Grande region does not eliminate it from its consideration as a Rio Grande representative. It is generally accepted that Pecos was occupied by Rio Grande people

and that there was a direct blood connection with Jemez to the northwest. When the Pueblo was finally abandoned there was a return to Jemez from which it had originally derived its strongest bonds.

Hooton's study of the burial remains from Pecos Pueblo has given us the most important stratigraphic data on Southwest Indian skeletal material. As a result of his investigation, Hooton was able to describe the sequence of changes in physical features, appearing in the Pecos population during the Pueblo's occupancy, and to describe its various elements. His deductions were based upon the division of the skeletal material by archaeological strata into four subgroups: Black-on-White and Glaze I, Glazes II and III, Glaze IV, and Glazes V and VI. Historically, the Black-on-White and Glaze I period encompasses approximately the dates from 1300 to 1425; Glazes II and III from 1425 to 1550; Glaze IV from 1550 to 1600; Glazes V and VI from 1600 to 1838.²

A comparison of the characteristics of the total Pecos skeletal material with those of our "Southwest Plateau" series reveals the presence of a number of consistent differences. In table 15 the means of the craniometric measurements and indices of the Pecos Total Series A (undeformed males) have been contrasted with those of the series of "Southwest Plateau" representatives. For purposes of simplification only the relative positions of the means have been noted by the use of plus and minus signs, and the situation summed up wherever possible in the "trend" column.

For glabello-occipital length the trend is for larger dimensions among the "Southwest Plateau" stocks than for the Pecos group. This was found to be the case for all four series which contained undeformed crania. The trend for maximum cranial breadth is for narrower widths among the "Southwest Plateau" groups. Basion-bregma height is definitely lower among the "Southwest Plateau" groups.

¹ Hooton, 1930.

² Kidder and Shepard, 1936.

TABLE 15. — POSITION OF MEANS OF "SOUTHWEST PLATEAU" REPRESENTATIVES IN RELATION TO HOOTON'S PECOS TOTAL SERIES A

MEASUREMENTS	PECOS TOTAL SERIES A	HAWKUP ZUNIS	UTAH BASKET MAKERS	PECOS "BASKET" MAKERS	ARIZONA BASKET MAKERS	SALT RIVER	BONITO- CHACO CANYON	PETRIFIED FOREST	CHAVES PASS	PUYÉ	TREND
Glabello-occipital length ...	175.74†	+	+	+	+	..	..	..	..	..	+
Maximum breadth	137.84†	-	-	-	-	..	..	..	..	..	-
Basion-bregma height	137.19†	-	-	-	-	..	..	..	..	..	-
Bizygomatic diameter	138.56	-	-	-	-	..	..	..	..	..	-
Nasion-menton height	119.38	+	+	+	(-)*	+	+	..	..	..	+
Nasion-prosthion height ...	72.85	+	+	+	+	+	-	+	+	..	+
Orbit height right	34.90	-	-	+	-	-	+	+	+	..	?
Orbit breadth right	39.47	-	-	+	-	-	-	+	+	..	-
Nasal height	50.96	+	+	+	-	+	+	+	+	..	+
Nasal breadth	25.80	-	-	+	-	-	-	..	..	..	-
Basion-nasion length	102.70	-	-	-	-	-	..	..	..	..	-
Basion-prosthion length	97.80	+	-	+	-	+	-	+	+	..	?
Palate length	55.04	-	..	+	-	-	-	+	+	..	-
Palate breadth	65.59	-	+	+	-	-	-	+	-	..	-
Height of symphysis	35.40	+	+	+	-	..	+	+	..	..	+
Cranial module	150.48†	-	-	-	-†	+	+	..	+	..	?
Cranial capacity	1338.71†	-	+	-	..	+	+	+	+	+	+
INDICES											
Length-breadth index	78.30†	-	-	-	-	..	..	..	..	..	-
Length-height index	78.11†	-	-	-	-	..	..	..	..	..	-
Breadth-height index	99.33†	+	+	+	-	..	..	..	..	..	+
Total facial index	85.69	+	+	+	+	+	+	+	..	+	+
Upper facial index	52.09	+	+	+	+	+	+	+	+	+	+
Orbital index	87.80	+	+	+	-	+	+	+	+	+	+
Nasal index	50.44	-	-	+	-	-	-	-	-	..	-
Gnathic index	95.97	+	+	+	+	+	-	+	+	+	+
Palatal index	119.16	+	..	+	-	+	+	+	-	+	+

* Not really shorter, see page 13.

† Calculated from means of measurements.

‡ Means of undeformed crania. The number in undeformed series runs about 80 and in the remaining more than 100.

Bizygomatic diameter is smaller in all nine instances than the Pecos mean. Nasion-menton height is larger in six out of eight groups. Similarly nasion-prosthion height is greater in all instances except in the case of the Puyé series. The height of the orbit presents no definite trend one way or the other, there being five series with shorter dimensions and four with larger dimensions than the Pecos mean. Orbit breadth is smaller in the "Southwest Plateau" stocks. Nasal height is larger and nasal breadth narrower. Basion-nasion length is shorter among the "Southwest Plateau" in relation to the Pecos series, but the trend in basion-prosthion length is uncertain. The palatal dimensions are probably smaller, but again the trend is not well marked. The height of the lower jaw at the anterior sym-

physis is greater among the "Southwest Plateau" stocks. Cranial module is in the majority of instances smaller in the "Southwest Plateau" groups, but strangely enough the cranial capacities are larger than at Pecos.

The trends in the cranial proportions are very clear-cut. The length-breadth index in the four undeformed "Southwest Plateau" series are definitely lower, as is also the length-height index. The breadth-height index, however, is greater in the "Southwest Plateau" stocks than the Pecos mean in three out of four instances. The total facial and upper facial indices are higher in every single case among the "Southwest Plateau." The orbital index is higher and the nasal index consistently lower. The "Southwest Plateau" representatives except those from Bonito-Chaco Canyon have

higher gnathic indices than the Pecos mean, in addition to higher palatal indices.

To summarize, the Pecos crania differ from the "Southwest Plateau" representatives in having a shorter cranial length, a wider cranial breadth, a higher cranial vault, broader and shorter facial dimensions, broader orbits, shorter and broader nasal dimensions, a longer skull base length, and possibly a larger cranial capacity. With regard to the proportions of these dimensions the Pecos series is more round-headed, presents a skull vault that is lower relative to the breadth and higher relative to the length, is relatively shorter and broader in the total facial proportions as well as in the orbits, nose, and palate, and shows less forward protrusion of the lower face.

Although it is clear that the *total* Pecos series, representing the complete span of the Pueblo's occupancy, is conspicuously differentiated from the "Southwest Plateau" groups, the possibility must be considered that a study of the Pecos population by archaeological periods might reveal other relationships.

The whole problem of population changes at Pecos was intensively studied by Hooton, who found definite trends throughout the successive archaeological periods for certain craniometric traits. To begin with, Hooton pointed out that cranial deformation was least common in the earliest periods of the Pueblo in the case of the males and seemed to increase in frequency and intensity in the later periods. Cranial capacity showed a slight and "possibly" significant increase from the early to the late periods in both sexes. Maximum bizygomatic diameter increased in both sexes from early to late periods. Nasion-menton height was greatest in males in the earliest period. Total facial and upper facial indices were highest in males in the earliest period, indicating faces proportionately longer and narrower becoming broader and shorter. Palatal dimensions showed a slight tendency to decrease in size from early to late periods. The gnathic index suggested a possibly slightly greater prognathism in the earlier periods. And finally, the mandibles of the earliest period were perhaps slightly smaller than those of the subsequent periods.³

The data suggest, then, that the trends of differences in physical characteristics from the early to the later Pecos periods are strikingly similar to those differences which distinguish the "Southwest Plateau" groups from the Pecos series as a whole. In other words, the population in the earliest Pecos periods were more like the "Southwest Plateau" groups than the people of the later periods. The closest resemblance is to be found with the Black-on-White and Glaze I period (which exhibits important similarities with the "Southwest Plateau" groups), and as we ascend the stratigraphic sequence, the differentiation from the "Southwest Plateau" pattern becomes increasingly greater. This is further supported by the fact that the Pecos "Basket Maker" series belongs to the early Pecos periods and is not represented at all in the latest periods. Hooton has clearly indicated that the "Basket Maker" type was the "first dominant type in Pecos and the earliest to decline and disappear."

It would seem, therefore, that the "Southwest Plateau" element was to be found in considerable strength in the earliest periods in the Pecos Pueblo and that subsequently it was modified and submerged in the later populations. The "Southwest Plateau" element was not the only type represented in the earliest periods at Pecos, but existed along with other types described by Hooton in considerable detail. The changes in the characteristics of the Pecos population in the later periods, according to this authority, were not the result of any radical changes in the composition of the groups but were occasioned by "the continuous process of amalgamation through inbreeding of the somewhat heterogeneous types of the earliest population."

Whether or not we accept Hooton's explanation for the physical changes in the Pecos population or adopt the supposition that there were continuous small additions to the population in varying quantities of similarly constituted strains, the available evidence indicates that there was already in the latter part of the Pueblo III period a considerably greater dilution of the "Southwest Plateau" element among the Pueblo peoples of the Rio Grande area than in the western part of the upland

³ Hooton, 1930, p. 78, etc.

plateau. This point of view carries with it the supposition that in the Pueblo I and II periods in the Rio Grande area the dominant element in the Puebloan population was the "Southwest Plateau" stock. Confirmation of this hypothesis must necessarily await further discovery and analysis of skeletal material covering these crucial periods.

The absence of adequate skeletal data from the surrounding area of the Rio Grande region makes it impossible at the present time to identify the various elements which existed along with the "Southwest Plateau" type in the early part of the Pecos period. The distinguishing traits, such as shorter cranial length, greater cranial breadth, more brachycephaly, greater facial width, greater orbital breadth, larger cranial capacity, etc., which mark the appearance of population changes from the "Southwest Plateau" pattern, are to be found in most of the groups originating immediately north and northeast of the Rio Grande area. The physical characteristics of such groups as the

Apache, Navaho, and Comanche are not incompatible with any supposition that they might have been responsible through admixture for modifications in the physical composition of the early Rio Grande Puebloans. From the historical point of view, the probability of the presence of Navaho, Apache, and Plains elements in the Rio Grande area during the Pueblo IV period is now generally accepted by students of Southwestern prehistory. Furthermore, cultural references to the probability that these elements existed in the Rio Grande area at an even earlier period than Pueblo IV are being actively investigated by a number of students.⁴ It should be clearly understood, however, that there is no somatological evidence at the moment that these groups were actually responsible for the physical changes in the Rio Grande population from their earlier composition. All that is meant to be implied is that they should not be dismissed as potential sources from both the historical and anthropometric aspects.

⁴Linton, 1944, pp. 369-80; Hibben, 1938, p. 136; Mera, 1938, pp. 236-43; Huscher, 1942; Hall, 1944, pp. 98-105.

SUMMARY AND CONCLUSIONS

IT IS not an uncommon event in research in working on a rather restricted subject to find that the scope and importance of the study had extended far beyond its original intent and design. Such has been the case in this monograph. Beginning as a study of the racial history and physical complex of the Zuni Indians of New Mexico, it was soon discovered that the nature of the findings brought into focus a much larger and more important problem, namely, that of the general racial history of the Southwest area. In addition, particular light seemed to be shed on the question of the Basket Maker-Pueblo transitional period.

An analysis of the Old Zuni Hawikuh crania revealed the fact that we were dealing with a group whose physical features were in many respects highly distinctive in character. They were distinguished by their small-headedness, their short skull lengths, narrow skull widths giving a cranial index on the borderline of mesocephaly and dolichocephaly, their high skull vaults both in absolute dimensions and in relative proportions, their long total facial and upper facial heights, and by their distinctive narrow facial widths. The nasal dimensions were characteristically mesorrhine, the orbits high and moderately narrow, and the palatal dimensions large, but in relative proportions revealed a shortness and broadness which places them in the mean brachyuranic class.

In the search for evidences of basic relationship and affiliation for this series of Old Zuni Hawikuh crania a comparison was made with the Grand Gulch Southeastern Utah Basket Maker series. The result of this comparison revealed the striking fact that the two series were virtually identical, the Old Zunis clearly representing this Basket Maker physical type. The significance of this relationship strongly indicated a further extension of this line of investigation with other groups of proven and suggested Basket Maker affinities. Accordingly, the Old Hawikuh Zunis were contrasted with the Pecos "Basket Maker" series and the Arizona Basket Makers de-

scribed by Hooton. The resultant analysis which included their interrelationship with the Utah Basket Makers, showed the Old Zunis to have virtual identity with the Pecos "Basket Makers" but somewhat lesser similarity with the Arizona Basket Makers. All these data merely served to support the previously suggested conclusion that the Old Zunis were of the Basket Maker physical type.

The fact that the Old Hawikuh Zunis were associated with the Basket Maker physical type made it necessary to inquire whether or not its particular physical complex was unique in the Southwestern area. The possibility was considered of a survival of Basket Maker physical type in the Zunis in contrast to the contingency of a general distribution of this form among other Southwestern groups. In order to explore these possibilities, comparisons were instituted with the Salt River Valley, Chaco Canyon, Pertified Forest, Chaves Pass, and Puyé groups. The net result of these comparisons showed that there were sufficient similarities with the groups to show that the Old Zuni physical type was not unique in the Southwestern area, but was on the contrary largely distributed over parts of Arizona and Northern and Western New Mexico. Since the groups showed such similarity and consistency in cranio-metric features, it was concluded that the several Southwestern skeletal series as well as the Zunis possessed a strong physical bond with the Southeastern Utah Basket Makers and as such must have been derived from the same or similarly constituted stock. This has been referred to here as the "Southwest Plateau" stock.

A study of the time relationships of the units forming the "Southwest Plateau" stock strongly suggested the existence of a continuity of "Southwest Plateau" stock from the Basket Maker period clear up to recent times. There was no evidence to show, from any data available at the present, that there was any other physical stock of the same level of importance as the "Southwest Plateau" Indians in the make-up of the Basket Maker-Pueblo

peoples. The presence of other physical types and deviations from the typical "Southwest Plateau" pattern among the Pueblos and especially the later Pueblos could be attributed for the most part to modifications of the original strain due to the absorption of new blood through intermittent small contacts, intermarriage, selective genetic factors, or to the result of stimuli persistently present in the environment. There is no suggestion of any sweeping change in physical type or of any enormous influx of new blood into the Basket Maker-Pueblo peoples until perhaps in the latter part of the Pueblo IV period, except in the Rio Grande region. In this latter area, the new elements arrived earlier and in greater strength than in the western part of the upland plateau region and served to obliterate the original "Southwest Plateau" type.

The suggestion that there was no wholesale arrival of new peoples or any sweeping change in physical type during the transitional Basket Maker-Pueblo period was not based on the evidence of skeletal data from the Pueblo I

and II periods. Such data were lacking at the time this concept was formulated. Since then, however, partial confirmation has been presented by Stewart as a result of the study of skeletal remains from the Whitewater District of Eastern Arizona.

Considerable attention is also given in this monograph to the loose use by anthropologists of such terms as longheads and roundheads, dolichos and brachys without citing the values of the cranial indices. It was pointed out that misstatements and abuse of the terminology of physical anthropology have been applied to the Basket Maker as well as the Pueblo remains. There can be no doubt that more proper handling of the basic somatological concepts must be observed, if we are to attain a better understanding of the racial history of the Southwestern area. What is needed is the careful analysis of such skeletal material as may be clearly identified and associated with cultural remains, if we can ever hope to unravel the many complex problems which challenge the students of Southwestern prehistory.

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HYPERBRACHYCEPHALY AS INFLUENCED BY
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BY CULTURAL CONDITIONING

BY
J. FRANKLIN EWING, S.J.

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TO MY MOTHER

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HYPERBRACHYCEPHALY AS INFLUENCED BY
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THE SUBJECTS OF THE EXPERIMENT

THE LEBANESE MARONITES

THE subjects for this experiment in comparative anthropometry are drawn from a group known as the *Maronites*. These are people adhering to a section of the Catholic Church known as an Oriental Rite; although united to Rome and completely a part of the Universal Church, an Oriental Rite is distinguished by the possession of a liturgy in a non-Latin tongue and by distinctive religious and canonical customs. That the Maronites are demarcated from other groups territorially adjacent to them not only by religious affiliation but by other factors with ethnic connotation will be shown in the course of this chapter.

THE HISTORY OF THE MARONITES

The Maronites (Leclercq, 1932; Labourt, 1910), although at present resident in the Lebanon, are originally from northwestern Syria. They derive their name ultimately from that of *Mar* (Saint) *Marūn*, who lived near Apamea (the present Qal'at el-Mudiq), in the fifth century A.D. (Timotheus, vol. 86, col. 65; Theodoretus, vol. 82, cols. 1418, 1431, 1491 ff.; St. John Chrysostom, vol. 52, col. 630). Apamea was the capital of the Roman administrative province of *Syria Salutaris*. The name of this Saint was given to a large monastery, located on the right bank of the Orontes River, between Apamea and Homs (Nau, 1902, II: 20-25). *Deir Beit Marūn*, or simply *Beit Marūn*, became a very large and important monastery (Ma'sūdi: 153; Burton, 1872: 64), and its representatives often had precedence in signing ecclesiastical documents (Mansi, VIII: 425-29, 1022). Gradually, a large number of the folk living in the neighborhood of the monastery (*Deir*) grew to be, and to become known as, adherents of the monks of the monastery, and the name *Maronites* was born. At first, it seems, the Maronites were grouped compactly around Apamea; later they are found farther along the Orontes Valley and elsewhere, e.g., at Ma'arrat-an-Noman,

Hama, and Homs; and, still later, at Aleppo and other more distant cities (Denis of Tell Mahrē, III: 362-64).

In the course of time the Maronites became involved in the Christological debates that engaged the Near Eastern world. In the seventh century first the conquering Persians and then the Mohammedan Arabs added new difficulties to their lives, for both sided with the Jacobites, who were Monophysites (founded by Jacob Baraidos in the sixth century), and the antagonists of the Maronites. Such hardship imposed from without could hardly have had any other effect than a strengthening of Maronite group solidarity. It is certain that by the eighth century a religious group known as the Maronites was clearly to be distinguished from other such groups in Syria (Labourt, 1910: 687); that is a statement of the utmost conservatism. This group always seems to have been predominantly a people of the mountains and hill-country.

As a result of opposition and persecution, the Maronites gradually began to seek refuge in a more sheltered area. The slow movement toward the northern and highest section of the Lebanon mountains began very probably in the seventh century (Dib, 1924, col. 32-33), and was certainly essentially complete by the ninth century. The once-prosperous monastery, *Deir Marūn*, fell on hard times; it was in ruins between the end of the ninth and the middle of the tenth century (Leclercq, 1932, col. 2202). But its lapse did not connote the end of the Maronite Church. The renewed organization of that Church in the Lebanese mountains was signaled by the erection of a Patriarchate. The exact dating of this event is disputed; but it gave formal expression to a process already substantially completed, namely, the creation of a "rite-nation."

Greek was the doctrinal language of the monks of *Beit Marūn*, but in all probability the people spoke a western sub-species of Syriac (Burkitt, 1929). At the time of the Maronite withdrawal into the mountains of the Lebanon,

the official liturgical language of these people, as well as the popular language, was Syriac. Gradually, Arabic came to be adopted, the process beginning with the southernmost parts of their territory; it is only about two hundred and fifty years ago that Syriac was completely displaced as the popular tongue (Roque, 1723: 175). The liturgical language remains Syriac. The linguistic fact helps corroborate the Syrian origin of the Maronites.

During the struggles that marked the history of the seventh century A.D. in Syria, we hear for the first time of one of the two chief candidates for factors of racial complication in the early history of the Maronites as a separate group. The *Mardaites* (their name is strikingly similar to that of the Mardians of northern Iran [Lawrence, 1935] whose appellation also has no ethnic significance), or "Rebels," are confused in the records with the Maronites. They came from the Amanus mountains, and entered Syria as auxiliary troops of the Byzantine Emperor, towards the end of the seventh century. After complicated political and military events, the chief of the Mardaites was murdered at Homs; the unit was abandoned by the Empire. Parties of refugees from the Mardaites fled to the Lebanon mountains. There they no doubt mingled with those of the Maronites who had already arrived. I have no data on the number of these Mardaites who settled in the Lebanon; I cannot think it was large (Lammens, 1921, I: 81-83; Hitti, 1940: 204-05).

The second group capable of supplying an addition to the Maronite numbers was that of the people of the littoral plain, which the Maronites would have had to cross on their way to the mountain. I have no way of estimating how much intermarriage took place between the early Maronites and the plains people, who could hardly have been racially very different from the peoples of the Syrian Saddle.

A third, and very much smaller, element of possible mixture with the Maronites at the time of their entry into the Lebanon range could have been the various brigand bands, which found the caves of the limestone mountains ideal operational headquarters. This sort of activity was of respectable antiquity (Strabo, bk. 16, c. 2, sect. 18); but the numbers of such brigands could hardly have been great, and

their ability to add any disturbing element to the racial blend was negligible.

In any case, the second two of the three groups just mentioned certainly (and the first probably) were of the Near Eastern brand of the Mediterranean race, characteristics of which are plentifully found in living Maronites. The people of the plains were of the same type as those of the desert-border of today.

The Maronites of the Lebanon, and elsewhere, were persecuted by various Mohammedan rulers, notably the Abbasids; this led to more than one revolt on their part (Lammens, 1921, I: 131-32). Such events, together with their new-found geographical concentration and isolation, must have further contributed to consciousness of group solidarity.

The Crusaders and the Maronites were on friendly relations from the start (Labourt, 1910: 685; Ristelhueber, 1925: 19-20). As a result of their alliance and of the continued support of the Crusaders, the Maronites were able to continue to consolidate their position in the north of the Lebanon (Lammens, 1921, I: 249). About the time of the final expulsion of the Crusaders (A.D. 1291), portions of the Lebanon range were invaded by two new groups. The first was that of the Metwalis, a Shi'ite Moslem group. The Metwalis came from the desert, and settled chiefly in the Beka'a, or what the Greeks had called Coele-Syria, namely, the valley between the Lebanon and Anti-Lebanon ranges (Lammens, 1929). The second group was that of the Druzes, who possess an eclectic and esoteric religion (Lammens, 1921, II: 13; Hitti, 1928; Hughes, 1885; Churchill, 1862). The Druzes settled chiefly on the southern and central slopes and ridges of the Lebanon range.

Seljuk, Mameluke, and Ottoman Turk rulers appeared in succession, the last holding sway from the sixteenth to the twentieth century. In the fifteenth, the Maronites, favored by a decimation of Moslem dissidents that occurred under the Mamelukes, overflowed into the Kesrūan, or south-central part of the Lebanon (Lammens, 1921: II, 16). From the sixteenth to the eighteenth century, they penetrated deeply into the Druze territory of the southern Lebanon (p. 93), assisted by internecine strife among Druze nobles. The two processes, penetration into Druze areas and symbiosis with

them (Laorty-Hadji, 1854: 77 ff.) continued; penetration, however, was slowed down after the beginning of the great emigrations of the Maronites to foreign lands. Symbiosis also existed between the Maronites and the various other religio-ethnic groups of the Lebanon (Rondot, 1947: 43 ff.).

Soon after the beginning of the nineteenth century, general restlessness in the area, further enhanced by foreign political intervention and the inept methods of the Ottoman Government, grew worse; in 1841, civil war broke out between the Maronites and the Druzes. The European Powers intervened, and two local governments were set up, a northern one for the Maronites, a southern for the Druzes. However, civil war soon broke out again. The disturbed political picture was further complicated by social and economic unrest. A climax came in 1860, when thousands of Christians were killed by the Druzes in the Lebanon (with the obvious connivance of the Turkish authorities) and other thousands by Moslems in Damascus. The Powers again intervened, and, by agreement, Emperor Napoleon III sent a military expedition to the district. An international commission set up a Sanjaq of Lebanon (whose boundaries were never definitely laid down), and established its autonomy (Hourani, 1946: 31-32).

After the first World War, the Lebanon (including much more territory than the old Sanjaq embraced) became a Republic under French Mandate; towards the end of the second World War, it rejected French tutelage, and it is now a completely autonomous state.

In spite of various vicissitudes, to which a minimum allusion has just been made, the Maronite nation had maintained its integrity almost completely (Thoumin, 1936: 26); its vassalage had only been demonstrated, for example in 1852, by the payment of a moderate amount of taxes (Laorty-Hadji, 1854: 81). This situation existed, evidently, because Turkish rulers were quite satisfied to leave immediate power in local hands (Hourani, 1946: 24, 27), so long as they received appropriate revenue and were caused no trouble; and because they recognized the principle of the "rite-nation," or the religio-ethnic group, according to which a person's status in political affairs was determined by his adherence to a

religious or other appropriate group located in a definite territory (Rondot, 1947: 23 ff.), and the Turks preferred to govern through the rulers of a group.

Because of its Christianity, its union with Rome, its historical connections with France (Hourani, 1946: 146 ff.; Ristellhueber, 1925), and other reasons, the Maronite group has always been the one most influenced by European culture in the whole Near East (Thoumin, 1936: 6-7) — a fact which has helped to strengthen its reserve towards its neighbors.

RACIAL CONSIDERATIONS CONCERNING THE MARONITES

Race and History

The realization of the fact, thoroughly attested by history, that the Maronites attained and maintained the status of "national" or group solidarity, allows me to continue their study by considering more closely: first, the factors contributing to the possible racial homogeneity of the Maronites; and second, the actual racial situation of that group.

History informs us that the population, a portion of which entered into the formation of the Maronites, was resident in northern Syria, partly in the "Syrian Saddle" (Semple, 1931: 177, 182 ff.) (also neatly called the "Syrian Corridor" [Lyde, 1938: 291 ff.]), but mostly along the banks of the Orontes River.

This whole region forms a part of the "Fertile Crescent," and contains, in consequence, a section of the main route from the Persian Gulf to the Mediterranean. Antioch was the principal and richest city of the Saddle and, later, when the Maronites established their Patriarchate, the Patriarch was named "of Antioch and the East."

Syria was not only fertile; it was from very early times (Woolley, 1942; 1946) the home of the middleman par excellence (Bury, *et al.*, 1923: 297). Playing this rôle, it was famous. It was not until the opening of the Suez Canal that the area lost its trading pre-eminence. Even the climate and the geomorphology are complaisant (Semple, 1931: 184).

Syria was broken up, politically, into numerous small city-states until the period of its

ites do not unduly complicate an already complicated racial picture. There could not have been too many of them, for the Arabic authors associate them with one particular village in the Amanus mountains; and their racial influence, even if they were of the utmost difference in type from the Maronites, would long since have been rendered that of a submerged minority.

By the ninth century A.D., the Maronites were safely installed in their bleak but sheltering mountain valley of the northern Lebanon. During the stay of the Crusaders in the Near East, there was some intermarrying of Maronites with the European bearers of the cross. These were probably for the most part French, Venetian, and other Mediterranean and Alpine folk, with a sprinkling of northern blonds (Lammens, 1921, I: 240). At the time of the Crusades, and for a century or two afterwards, the chief traders in this area from Europe were Venetians and Genoese (Rey, 1883; Heyd, 1923). Occasionally I heard mention, in the Lebanon, of a marriage with a French or an Italian Catholic in a Maronite colony, e.g., at Aleppo. Not only, however, were these marriages with Europeans largely confined to the upper classes, and small in number compared with the total Maronite marriages through the centuries, but the European contribution to the racial stock pot of the Maronites would be almost completely of elements, Mediterranean and Alpine, that were already represented there in large percentages. The same could be said, no doubt, for the Syrian Christians who joined their fortunes and their lives with those of the Maronites, from time to time (Volney, 1823: 468). Finally, the memory of family history is so long in the Lebanon, that the event of a European marrying into the family would still be remembered and mentioned hundreds of years afterwards.

This leads me to consider the factors that should be expected to produce racial homogeneity in the Maronite group, their history having given ample evidence of heterogeneity of origins and early experiences.

The most important factor, one of obvious and real importance in the Near East, is that of religious affiliation. I need submit no particular documentation when I say that religious lines are great barriers between peoples here, in terms of intermarriage. Even today, after

the seeming relaxations of old customs consequent upon the first World War and subsequent vicissitudes, I am safe in saying that a Maronite would not often marry a Greek Catholic (who differs from him only in rite, since both groups are Catholic), much less a Moslem. Religious lines are indeed large elements in ethnic lines throughout the whole area (Lammens, 1921, I: 5; Kappers, 1934: 6; Rondot, 1947).

The marginal nature of the Lebanon terrain, and the intense group consciousness which centuries of comparative isolation and minority life have created, are other factors which are conducive to homogeneity. The closeness of the Maronite farmer to the land also slows down racial change, for the peasant is a conservative creature. It was almost exclusively this class that I studied while in the Lebanon. The average Lebanese Maronite man marries a woman of his own village. In making this statement, I refer to the mountain farmer. Of 179 men in my various series who had married, 92.7 per cent had taken a wife from the same village, while 4 others had wives from villages so close by as to be indistinguishable from the man's village. So, effectively, 94.9 per cent of the men studied had married locally. With but rare exceptions, this sort of thing has been going on among the Maronites since at least the ninth century. We have, therefore, a people drawn from a population of diverse origins. These origins contributed a limited number of racial complexes to the composite; these I shall list in the next section. This people then settled down to relative isolation and narrowly local endogamy.

The Present Racial Status of the Maronites

Speaking generally, the Maronites do not strike any discordant note in the anthropological chorus of the mountain-dwellers of the Near East (Seltzer, 1936; Kappers, 1934: 12-28; 193).

They are the most hyperbrachycephalic of any people in the neighborhood. Their cephalic index is 88.43, in the case of my adult male series; 254 (male and female) skulls yielded an index of 87. However, near-by Nosariyeh, Metwalis, and Druzes come close to this very high index (Seltzer, 1936: 12; Shanklin, 1938; Chantre, 1881-82: 179).

Metrically, my series agrees fairly well with the small one of Huxley (Seltzer, 1940: 38), who measured 31 Maronite males. Huxley's subjects were not so planoccipital; he gets a longer head length and a narrower head breadth than I obtain; and his head height is so much greater than mine (almost 9 millimeters) that a difference in technique must be deduced. However, I shall discuss the metric details of the Maronite head and face in the next chapter. Maronite male stature is a shade over 167 centimeters in average.

My Maronites are not too different also from the Lebanese measured by Cline (Seltzer, 1936). I interpret his somewhat longer and narrower heads and faces as being due to a greater amount of Moslem Arab in his sample.

A preliminary sorting of my Maronite series by photographs clearly shows that there are the following predominant racial elements in the Maronite group (following the terminology of Hooton, 1946: 576-78): Upper Palæolithic, Iranian Plateau, Classic Mediterranean, Alpine. There is a fair amount of what Seltzer (1936) calls "Armenoid," in the sense of a light-brown-eyed, depressed-nasal-tip strain. In addition to the predominant elements, in terms of primary sub-races, there is a not inconsiderable amount of Nordic. And finally, there is just the faintest trace of Negroid.

Considered from the point of view of the various sigmas and coefficients of variation (Howells, 1936), the Maronites are not noticeably heterogeneous.

Since it would lead me too far afield at the moment to submit a more detailed account of the anthropology of the Maronites and a comparison of these people with their neighbors, I take the liberty of considering this brief account sufficient for the treatment of the racial characteristics and position of the Lebanese Maronite subjects of our experiment.

THE MILIEU OF THE MARONITES IN THE LEBANON

Geography (Keller, 1933)

The present boundaries of the Republic of the Lebanon (fig. 2) include much more territory than did those of the old Sanjaq of Mount Lebanon. The Sanjaq was composed of the Lebanon range, which was largely populated by Maronites, except for the southern section,

the district of the *Shūf*, where the Druzes long held out. The Sanjaq was considerably larger than the original nuclear district of the Maronites, around the Qadīsha River in the north of the range.

The State of Greater Lebanon, which became the present Republic of the Lebanon, was set up by the French after World War I, under mandate from the League of Nations. One side is bounded by the Mediterranean. The land boundary line (which encloses some 10,000 square kilometers) starts at the Mediterranean, north of Tripoli, follows the Nahr ei-Kebīr eastward for a while, then turns southwestward; thence it follows the crest of the Anti-Lebanon mountains; leaving this line, it runs irregularly southwest and west to Nakūra, once more on the Mediterranean, south of the mouth of the Litani River. This state includes not only more than the original focal area of the ancient Maronites, but a great deal more than the area of their greatest expansion. The broad valley of the Beka'a, the western slope of the Anti-Lebanon range, the whole area of the southern Lebanon, the coastal plains and cities—these are all accretions, with respect to the Maronites.

A number of different groups always lived in what I think of here as Maronite territory; their numbers are increased in the Republic of the Lebanon. The following list of the religio-ethnic groups that go to make up the populational mosaic of the Lebanon is compiled from Hourani (1947):

Maronites	327,846
<i>Other Christians</i>	
Greek Orthodox	109,883
Greek Catholic	64,280
Armenian Orthodox	59,749
Armenian Catholic	10,048
Syrian Catholic	4,984
Syrian Orthodox	3,753
Protestants	10,440
Latins	3,117
Chaldaeans	1,330
<i>Mohammedans</i>	
Sunnis	235,595
Shi'ites	209,338
Druzes	73,311
Jews	5,666
Various	6,261
Total	1,125,601



FIG. 2. Map of the Lebanon, showing principal towns and other features.

The Maronites are largely concentrated in the Lebanon mountains and along the coasts of the Mediterranean, between lines drawn eastward from Tripoli and Sidon, respectively. The other Christians, with the exception of the Greek Orthodox, are mostly confined to the cities. The Sunni Mohammedans are especially to be found in the very north of the present Lebanon, and in Tripoli and Beirût, although a fair number are resident in the southern Lebanon and in the Beka'a. The Shi'ites' greatest strength is in the Beka'a and in the southern Lebanon. The Druzes inhabit the mountains east and southeast of Beirût.

These various groups are not unified in origin. Thus, many of the Moslems are from the "desert-border population" (Kappers, 1934: 68); the Armenians are obviously not long resident in the Lebanon in such strong numbers. Hence it is that a series like that of Kappers (1934: 22), labeled "Lebanese," may well turn out to be far from homogeneous; the same may be said for other series.

The capital of the young state fashioned from an old land is Beirût, called "Berytus" in Roman times, when it was famous for its law school. As one comes to Beirût by ship, one sees it against the massive gray-white backdrop of the Lebanon range. The topmost mountains are generally mantled in snow, and when there is no snow, the white highest limestone helps confirm the etymology of the name of the range and the country, the "White" (note the Aramaic *laban*, "white"). The Arabic name is *Libnēn*. The Lebanon range is far higher than its counterpart, the Anti-Lebanon range. The highest peak, Qurnet es-Saouda, in the north, rises to some 10,000 feet; Jebel Sannīn, to the south of that peak and visible from Beirût, is 9200 feet tall. From there the altitude diminishes the farther south the range is followed.

Along the coast of what was once Phoenicia, one finds the "out-door museum" at Ras el-Kelb, on whose limestone promontory passing armies have carved or attached their inscriptions from the days of the Assyrians to our own time; Byblos (now called Gebeil), with magnificent excavations revealing local human history from the Neolithic to the present; hints of ancient worship, such as the "Well of Astarte" or the sacred carp of Sheikh Bedawi (named after St. Anthony of Padua,

for there was a Franciscan Convent here during the Crusades), near Tripoli. At the head of the stupendous gorge of the Qadisha River stands the pitiable clump of the Cedars, all that is left of the once prosperous forests of these trees. The wood of the fallen ones went to make ships of the Egyptian navy or mummy cases for the land of the Nile (Woolley, 1946: 182), or was enshrined in the Temple at Jerusalem (3 Kings, chaps. 5, 6, 7), or was scattered abroad to play more prosaic rôles. In the Beka'a, the remains of the formidable concentration of temples at Baalbek are justly famous. Ruins of Crusader fortresses and of towers dating from the times of the Mamelukes; hidden temples, like those of Afka (where Venus and Adonis were worshipped) and Qal'at el-Fakhra on its remote clifftop; caves and rock shelters and terraces strewn with prehistoric flint tools—these and a hundred other relics of man's past in the Lebanon vie for attention with the motley mosaic of present human populations, themselves the product of so much history.

It is only recently, as secular events go, that the Maronites have expanded beyond the region to which they first came, the upper gorge of the Qadisha River. There they found spectacular scenery, but hard living. The great white ridge towers over bare slopes, with here and there a stretch suitable for terracing. The country had not been cultivated before, and every available bit of land was soon built up into terraces, primarily for wheat; stone houses were built, and numerous mountain nooks and tops were supplied with churches. It is symbolic and fitting, in view of later Maronite history, that the valleys of the Lebanon range occupied by the Maronites now and later open out towards the west (Thoumin, 1936: 3). At first, and for long, however, the geography of the northern Lebanon offered refuge to the Maronites; and this stern and bare land demanded characteristics which became theirs: sturdiness, laboriousness, cohesiveness.

Geology (Zumoffen, 1926; Dubertret, 1933a)

The Lebanon range runs parallel to the Mediterranean coast and also flanks the western edge of a continuation of that depression, which, followed along the Jordan Valley, the

Dead Sea, the Gulf of Aqaba, and thence across the Red Sea, leads one to the Great Rift Valley of Africa. The Lebanon and Anti-Lebanon ranges are twin horsts, with the fossa of the Beka'a between them. The Beka'a seems rather to be the result of differential movement along a single fault, than a mere continuation of the Great Rift Valley. The northern end of the latter comes to rest in the Beirût area; there a new fault begins.

Jurassic limestone forms the core of the Lebanon massif. It is often widely exposed, and where it is, karst topography is developed, with its weird erosion-carving and its hidden little valleys. The higher parts of the plateau block are capped by Middle Cretaceous limestone (which is in turn lower than the Eocene limestone), and where it appears the relief is gentler, although still dolomitic. The two limestone series are separated by a complex of sands and clays, among which is the Nubian sandstone. These sands and clays produce a more fertile soil. A less profitable deposit is the chalky marl, of late Secondary and early Tertiary age, which occurs especially in the southern Lebanon. It forms a crusty hardpan, which resists current agricultural methods. In the Sidon area, this crust is some 13 feet thick (Fish, 1944: 239). Elsewhere, there are local deposits from younger periods: pockets of sands and clays and gravels, and of sandstones and conglomerates. Recent alluvial soils are found along the coast, and the Beka'a is rich in alluvial loam.

The underlying geology is of the utmost importance to the Maronite population. It, together with the climate, produced the soil, and the soil is pre-eminently important in the life of a people primarily agricultural. An additional factor is, of course, man himself, who has ruined so much of the soil by intensive deforestation, and made so many of the barren hillsides habitable and cultivated by multitudinous terraces. The configurations of the rocks, acted upon by weather and fluvial erosion, furnishes the Lebanon with those tiny, isolated and charming valleys, typical of karst country; with the moderate slopes of the more recent limestone; with the precipitous cliffs and sharp, deep gorges that helped to keep alien human influence at a minimum.

Once most of the trees had been cut down — a destruction that was already far advanced,

but not yet consummated (Thoumin, 1936: 167), long before the Maronites arrived — there were no mineral resources to tempt the ambitious conqueror, who would unwittingly add new anthropological elements to the existing mixture. In the Lebanon there are the ruins of a few tiny iron mines, worked perhaps in the second millennium B.C.; the Lower Cretaceous rocks contain an occasional lens of lignite, not worth the effort of extraction (Fish, 1944: 240).

The geology of the country is kind to the Maronites in one important respect: it allows of numerous springs and a fair number of short but permanent rivers. The water, percolating through the more permeable limestone cap (Jurassic rocks are particularly permeable; the Cenomanian-Turonian and Middle Eocene, very permeable), reaches a resistant level (the Neocomian-Aptian-Albian and the Pliocene are especially impermeable) and bursts forth in a line of springs (Dubertret, 1933b: 450). "*La percolation des massifs-réservoirs est accompagnée de frottements importants et est lente, circonstances à la faveur desquelles se constituent de vastes accumulations d'eau, dont témoigne la constance des débits de nombreuses sources, en dehors de la saison pluvieuse, soit dans le cours d'une même année, soit d'une année à l'autre*" (p. 452). Because of topographical and social factors (Thoumin, 1936: 96-97), the Lebanon has no great system of irrigation. The farmers depend on the winter rains for the watering of their crops. But there is always fresh and sweet water to drink from the springs.

Climate

The orography of the Lebanon co-operates with the latitude and geographical position of the area to produce the climate. The general type experienced here is that called "Mediterranean" (Blair, 1942: 367; James, 1935: 95), characteristic of the western edges of continents in the fairly low latitudes. It is similar, for example, to the climate of parts of California. This type of climate is noted as possessing: (a) mild winters with light to moderate rainfall, (b) warm summers, with considerable periods of no rain, (c) abundant sunshine in both periods, (d) a natural vegetation consisting of broad-leaved evergreens and drought-resistant trees and shrubs, (e) a mean temperature, in

the coldest month, of above 43 degrees F., and more typically of one of about 50 degrees F.

The climate of the various parts of the Lebanon might be further distinguished, especially as regards maritime, mountain, and inland areas (Combier, 1933), but this general description will suffice, especially as no stations seem to have been set up for meteorological observations exactly in the northern Lebanon at high altitudes, and hence accurate data for that area are lacking.

The rainfall is notable here in the winter, since the barrier of the Lebanon range is a command to the wet western winds of winter, coming in from over the Mediterranean, to let down their load of rain (Semple, 1931: 89). In the summer, the high, cool lands of the northern Lebanon often experience a pleasant dew at nightfall, a factor that farmers, in other unirrigated Mediterranean lands, take into account (compare: Genesis, c. XXVII, v. 28; Odyssey, Book XIII, lines 244-45).

The natural flora of the Lebanon need not be discussed here, beyond the statement that its distribution is spotty, due again to deforestation, and its character typical of Mediterranean countries with similar geographical and topographical conditions (Boulomoy, 1930; Thoumin, 1936: 11-14; Semple, 1931: 262 ff.; Fish, 1944: 244).

THE CUSTOMS OF THE MARONITES IN THE LEBANON

In this section, such customs of the Lebanese Maronites as directly affect their physical and racial status will be emphasized. Brief remarks concerning other customs will only be made with the intent of rounding out the picture of the life of the people. The conditioning they receive in the Lebanon precisely as subjects for our anthropometrical experiment is our paramount interest at the moment. However, the Maronites are not so well known in anthropological literature, that information on their way of life is completely superfluous and irrelevant.

Housing (Thoumin, 1936: 292-95)

The Maronites of the mountain villages of the Lebanon live in stone houses, made of large, fairly well-tailored blocks of limestone. The walls are usually plastered inside with a marly

clay or with plaster; the floor is of beaten earth or of stone slabs. The roofs of the houses are either flat (of beams, brush, and earth in the Near Eastern manner) or tiled and gabled (after the recently introduced foreign manner). The houses are simple, but quite adequate. There are very few indoor toilets, but folk who do not possess the American preoccupation with plumbing do not mind this. The houses are, for the most part, equipped with occidental chairs and tables, and squatting is not the usual custom in the house, although an occasional amount of it is done in the fields or elsewhere. There is no other method of heating the house in the winter than the charcoal brazier. In general, the Lebanese houses are superior to the dwellings of many other inhabitants of the Near East.

Villages

The organization of the villages, and the types of villages that one finds in the Lebanon (Tannous, 1944b; Thoumin, 1936: 283 ff.), are not of too much importance to this study. The terrace-villages drift gradually down the slopes of valley sides, which are broken by more or less definite terraces (e.g., Kartaba). The crest-village ("Strassendorf") consists of a row of houses on either side of a street which follows the crest of a mountain (e.g., Muzraat Kofr Debian). The hilltop-village (a type which may well include the plateau-village) takes advantage of the brow of a hill or the somewhat flat remains of a plateau near the gorge carved in it (e.g., Kforsghob, Bsharrê). In any case, getting about a village usually demands considerable muscular exertion on the part of the citizen.

The altitude of the villages varies from slightly above sea-level, for the coastal Maronites, through the low and sloping provinces such as Kesrūan, up the steep inclines of the Lebanon range to about 6000 feet. The majority of my Lebanese Maronite subjects live at moderate to considerable altitudes. It is impossible to say whether this fact has any bearing on measurements and observations. I doubt that there is any; no difference was observed between smaller series made up of lowland and highland Maronites, respectively.

A large number of the people who were measured in a village at a high altitude spend

their winters on the littoral plain. The phenomenon known as transhumance, which occurs elsewhere in similar geographical situations (James, 1935: 330; Brunhes, 1925, chap. 8; Thoumin, 1936: 155), and which denotes a shifting of the residence to lower or higher levels according to the season of cold or warmth, obtains here. In the Lebanon, some folk go so far as to have two villages: a summer village at high altitudes, and a winter village at low levels (e.g., Tannurīn el-Fawka and Tannurīn el-Takhta).

Communications

The present boundaries of the Lebanon enclose railroad lines, but no railroad complicates the life of the residents of the mountains themselves. Of recent times, the automobile and the asphalt road have penetrated the range. Various roads travel up the principal valleys and along the main ridges. Thus the age-old isolation of the Maronites has been broken. The effects of the automobile on the Lebanon have been many and important (Thoumin, 1936: 182 ff.), but most of the small farmers and laborers of the mountain Maronites have been little affected by this recent invention. The future effects are only a subject for speculation.

The Life Cycle

MARRIAGE, BIRTH, INFANCY

Marriage customs among the Lebanese Maronites have not changed essentially since 1914 (Chémali, 1915-16), except for the disappearance of the "horn" (*tantūra*) which decked the head of the bride. It is as true now as it was then that people marry young in the Lebanon (p. 913). There is, I think, much more of the element of personal choice in the selection of a spouse than there was of old, but, as I have already indicated, a man usually marries in his native village.

The Near Eastern preference for a male child as opposed to a female child might lead to greater care being taken during birth and infancy of the male child, but this is difficult to determine. There are numerous interesting customs associated with the birth of a child (Chémali, 1910) but I pass them over as non-

essential, to discuss at length a custom practised during infancy which is of the most fundamental importance to our present study. That is the cradling of the child.

As will be seen from the photographs, the Maronite cradle, although simpler in decoration as a rule, is very close in form and function to that of the Armenians (photographs, Virchow, 1924) and to that of the peoples of the Caucasus (Pflug, 1923; pl. 5, no. 21).

It is made of wood (fig. 3, *a*), and is typically of the rocker type, although occasionally hanging cradles are encountered (Chémali, 1910: 738, and pl. opp.). The hanging type is rarer. Between the headboard and the footboard of the rocking cradle runs a rod of wood, longitudinally, above the place where the infant will be laid. This may well be presumed to strengthen the structure. It is also employed by the mother, who leans on the rod when suckling the infant (which remains tied in the cradle meanwhile); and from it hang religious medals for the infant's protection, rattles, and other toys, designed to distract the baby (fig. 3, *c*).

The floor of the cradle, it will be noted, has a hole bored through it. Above this hole is a corresponding one in the mattress; the bed linens that lie under the infant are likewise perforated. When the cradle is made up, a pottery conical-based receptacle is inserted in the opening. This receptacle has a rim which prevents it from falling through.

The newborn infant is carefully wrapped in swaddling-bands, fully extended, with his arms exactly at his sides. He is placed on his back in the cradle. A lead-off tube (what Pflug, 1923, calls "Urinableiter") is attached to the penis of a male infant; a similar, only slightly modified one is inserted between the labia of a female infant. These lead-off tubes resemble nothing so much as tobacco pipes and are sometimes bought as such in the bazaars by tourists. Excellent illustrations of them are given in Lortet (1884b: 36); and a description of the cradle, by the same author, is as valid today as in 1884 (Lortet, 1884a: 84-87). The infant thus lies, swaddled, on his back, with what would be the stem of the tobacco pipe protruding through the swaddling-bands and directed into the receptacle. The little mummy

is again wrapped, but this time the bands encircle the body of the cradle as well (fig. 3, *d*), so the infant is securely fastened to the cradle. The exact placing of these bands may differ with different families and localities.

In some cases the infant is placed in this cradle immediately after the activities subsequent on birth (Pflug, 1923: 220), but certainly he is so cradled within a very few days after his entry into the world (Chémali, 1910: 738; Ploss, 1884: 113). My observations on this point—as on cradling is general—concur with the data given in the literature.

Whatever the individual variations, one important point to note is that the infant is *always* placed in and fastened to the cradle lying on his back. The second note of moment is the fact that the baby is so immobilized the greater portion of the day and night, and for a great many months. As a rule, the baby is taken out of the cradle only once a day, when the linens are changed. He is even fed while secured to the cradle. This goes on for a minimum of nine months, and a usual maximum of a year.

An important factor, the consequence of which will be realized in Chapter III, is the position of the pillow. This position falls into two categories. In the first case, representing the minority I should judge, the pillow is simply left flat under the head (fig. 3, *c*). In the second case, the pillow is arranged under the neck so that the child's chin is raised (fig. 3, *b*). This, according to local lore, tends to produce a longer neck—an esthetically desirable trait. In this second case, the child's head rests on the pillow, not on a plane parallel to the median transverse section plane of the body and head, but at an angle, with the lambdoid region pressing more firmly than the iniac region on the pillow.

The period of suckling the infant may last long; according to Chémali (1910: 739) for one year, two years, or even more. I am inclined to think that this period is not so lengthy these days.

During early infancy there is no deliberate cranial deformation practised on the child—no apparatus, no massaging of the head with the adult's hands. Gentle massage of the limbs with oil is frequently employed.

There has always been a fair amount of schooling given the boys in the Lebanon, espe-

cially in Syriac, the liturgical language (Chémali, 1917-18), and after World War I numerous French and some American schools were set up (Tannous, 1944a). But the average boy of the average farmer begins early to participate in the laborious life of his father.

There are no mutilations practised on the growing boy or adult man among the Lebanese Maronites. A possible exception to this statement is motivated by medical beliefs, and is not important to our study. At, or extremely near bregma, there often appears a depression (visible on bald heads and often noticeable on skulls) made by the point of a red hot iron firmly applied to the head. The operation is performed for the purpose of curing prolonged colds or other bothersome respiratory troubles. The same operation is done on sheep, for the same purpose, and in the same way. Perhaps this has some distant relationship to the "T sincipital" of Manouvrier (1895; 1903; Grön, 1910), observed on Neolithic skulls; and to what Bockenheimer (1922) describes on Guanche crania (other references in Dingwall, 1931: 75).

Nothing about Maronite clothing, either old-fashioned or occidentalized, seems to have any direct relation to the shape of the head. The fairly heavy felt conical cap, its base surrounded by a turban-like cloth, is not adopted until a boy is well grown. It is being gradually supplanted by the *tarbūsh* (fez) and western-style hats.

SUBSISTENCE

The Acquiring of Subsistence. The labor of acquiring subsistence is, for the majority of the Lebanese Maronites, agricultural. It is seasonal work, depending as it does on the rains; it is even more laborious and less profitable than the work of an American farmer, because the tools (Thoumin, 1936: 134-35; Wakim, 1933) are not modern, and the small area of the difficult plots on the terraces prevents any use of farm machinery.

The type of plow is that universal in the Near East and familiar to all from illustrations in books on Egypt. For digging by hand there is the three-man spade (one pushing it, the others pulling on a rope attached to the shaft), the ordinary spade, and the large hoe. Other tools are the ox-drawn harrow and the threshing sledge (Thoumin, 1936: 136). This is

pulled by oxen around the surface of the built-up threshing area, many of which stand like low towers among the mountains (compare Wetzstein, 1873).

The Maronites found bare peaks and only isolated tiny patches of good agricultural land when they came to the Lebanon, and, in the course of the centuries, they have covered every available slope with terraces. This terrace-building is still part of the farmer's work. In addition to the labor associated with the cultivation of fields and orchards (Thoumin, 1936: 137-39), there is the set of activities connected with the care of sheep and goats. There is intermittent stonework, on houses and walls. Gathering the heavier wood for family use is also a man's job. Little hunting or fishing is done by the Maronites now, as returns have diminished to a minimum.

Omitting consideration of the few who follow specialized callings, I may sum up the work-life of the average Maronite of the Lebanon mountains as one which is laborious and toughening, but not particularly more so than that of the average American farmer a generation ago.

FOOD, DRINK, STIMULATION. I shall here give a brief account of the variety of stuffs available to the Maronites for food and drink. The qualification need scarcely be added that this represents a general, over-all picture. Not all the materials here mentioned are at hand at all times or in the same quantities for all individuals. I have no more accurate data to present, but could wish for more.

Cereals. "The reward of cereal cultivation is greater than that of any other form of agriculture," says Forde (1937: 418), and cereals form the greater part of Lebanese agricultural products. Among these, wheat is pre-eminent. It is used in great quantities in the flat, whole-wheat bread characteristic of the area, and in combination (usually as cracked whole-wheat) with meat and vegetables in various dishes. The value of wheat as a food need not be emphasized.

Barley is grown a little; it is looked down upon, being considered primarily a food for animals. Maize is also grown somewhat; durra occurs, but rarely. Rice is imported in considerable quantities and is used in the various "stuffed" dishes so dear to the Maronites.

Vegetables. The list of vegetables appears imposing, but the qualification already given

still holds. On the list are: tomatoes, onions, various salad greens, an increasing amount of potatoes, mint, garlic, eggplant, cucumber (a great favorite when in season), cabbage, peas, various beans, squash, carrots, and beets. The last five items are of relatively recent introduction, at least in any quantity. Vegetables, on the whole, are of greater importance in the daily lives of the Lebanese Maronites than is meat.

Milk Products. Milk, usually from goats but occasionally from cows, is fermented into *laban* (like yoghurt) and eaten in that form, or further elaborated into *labni*, a sort of tangy cream cheese. The use of butter is practically unknown here. The protein and mineral value of these milk products in the daily diet of the Maronites is obvious.

Meat. The chief sources of meat in the Lebanon are sheep and goats. The sheep are of the fat-tailed variety, the magnitude of whose caudal extremities was exaggerated by Herodotus (bk. III, sect. 113). In the mountain villages, the animals are slaughtered on a Sunday; meat for the meals of the whole week is unheard of (even apart from days appointed by the Church for abstinence from meat). A very small amount of the meat (especially tender portions of lamb and liver) is eaten raw, as part of the *canapés*. A much larger amount is eaten, still raw (pounded into a paste with softened cracked wheat), in a favorite dish, *kibbi-nēych*. The rest is fried, roasted in small pieces on spits, employed in stews, or mixed with rice and pine nuts in the "stuffed" dishes (cabbage leaves, young grape leaves, small squash, for example). Not so much chicken, and no pork is to be noted here. An occasional hapless hare is caught in the fields and eaten.

Fruits. Olives are a staple of the diet of the Lebanese Maronites, and supply them with oil. Figs and apricots are favorites. Dates are much rarer here than in Iraq. Melons in season are plentiful on the coast. Oranges are grown locally to an extent, but most, together with grapefruit, are imported from Palestine. Some bananas are grown in small patches along the coast. Various American and French fruit trees have been imported recently, and apples, plums, and pears add to the variety of Lebanese fruits.

Pistachio nuts and almonds are the commonest nuts eaten. Walnuts and peanuts are sporadically abundant. I never observed any use

of acorns for food, although it seems a widespread enough eastern custom in eastern Mediterranean lands (Gifford, 1936).

Sweets. Sweets do not figure very prominently in the average diet of the Maronite farmer, except on major feast days. The flaky, honey-drenched pastry is typical of the Near East. Very little sugar is grown locally. Fresh grapes are boiled down to make a grape honey, much like molasses; a similar molasses is made from the pods of the carob tree.

Condiments. There is nothing extraordinary about the list of condiments: salt, pepper, garlic, mint, vinegar, and some mustard. However, much larger amounts of mint and garlic are used, especially in salads, than is customary in the United States.

Beverages. The universal drink for "cocktail time" is *arrak*, a very strong, colorless grape brandy, flavored with liquorice. *Arrak* is drunk mixed with water, the addition of which turns it white. The native cooked wines are also drunk.

The very strong, very thick, very hot coffee, served in tiny cups, characteristic of the Near East, is also in favor here. Sugar is added to taste. This beverage has strong social connotations, being associated with the pattern of hospitality, the ceremony of business, and the smooth flow of social intercourse.

Narcotics. The only narcotic employed by the Lebanese Maronite (except alcohol) is tobacco. The old narghile, leisurely in preparation and enjoyment, is yielding to the quicker cigarette. A certain amount of chewing of tobacco occurs, and the older folk often use snuff.

DEMOGRAPHY AND EMIGRATION

Demography

The population of the Lebanon is concentrated (Thoumin, 1936: 280) in the following areas: around Tripoli, Batrūn, Gebeil, Beirūt (a very large district, the Shūf, is thickly populated here), and Sidon — these areas are along the coast; in the mountains, there are areas of concentration around Sīr, Bsharrē, Kartaba, and Beskinta; this last area is continuous with the district of Kesrūan, which in turn merges into the Shūf. The actual ridge of the range

is uninhabited, and the eastern slopes of the range, steeper and provided with much less rain, are not populated, with the exception of a few towns at the edge of the Beka'a valley. The rest of the country has less than twenty persons per square kilometer. This distribution is described, naturally, with focus on the Maronites.

The population of the whole Lebanon, according to the census of 1932, was 885,000, including some 61,000 aliens (Fish, 1944: 251; Dodd, 1940: pl. 1, opp. p. 16). The total population given by Hourani (1947: 63), as of December 31, 1944, is 1,126,601; but I am not sure whether this total includes people inscribed under the different confessional categories but not actually living in the Lebanon. At any rate, my own studies of the Lebanese Maronites were made at a time when the population was probably not much greater than that indicated by the older figures. The density of population is over a hundred per square kilometer (Tannous, 1944b), or at least around a hundred (93, according to Fish, 1944: 251). Bonné (1945: 141) offers the following figures for the Lebanon, as of 1935: total area, 9355 kilometers²; cultivable area, 5604 kilometers²; population, 865,693; density per kilometer² of cultivable land, 152.5. On the basis of these figures, the people of the Lebanon have about 1.6 acre of cultivable land per person. Sax (1945: 260-62) estimates that 2.5 acres of arable land are needed to provide a person with food, clothing, and other necessities. This estimate is based on a reasonable crop standard and a reasonable standard of living. The more productive countries of Europe are able to support about one person per acre of arable land, after allowing for food imports. In the United States, we have been using about three acres per person; if we reduced our dietary standards to those of prewar Europe, this would permit us to get along pretty well on 1.5 acres per person; were we to be satisfied with the standard of the Asiatics, 0.5 acre would suffice for our needs.

These figures throw some light, I believe, on the subsistence-level of the Lebanese Maronites. The Maronites may have rather a poor time of it, judged by the norms of the pampered American; but their standard of living is quite sufficient. However, there is not a large

margin for surplus population; and I suspect that some of the figures I have quoted are based on an overestimate of the quality of the arable land.

The Near East, in common with other Mediterranean countries and with much of southern Asia (Bonné, 1945: 8) has a birth rate several times higher than that of European countries of the temperate zone, except Russia. The birth rate for Syria and the Lebanon is 30-45 per thousand. It is that of an unindustrialized area, compared with the European rate (Davis, 1945: 3-5) — a fact that will not unduly surprise the reader. But the death rate is also much higher than, say, the United States (Tannous, 1944b: 524).

The percentage growth of population for Syria and the Lebanon together, from 1900 to 1938, has been 145.8 (Bonné, 1945: 10). This growth has occurred in spite of the great amount of emigration from the Lebanon, which I shall discuss in the next section. At least some of this growth has been adventitious. In 1939, for instance, there was a large influx of Armenians from the Sanjak of Alexandretta, when that area was handed over to Turkey.

A noticeable amount of urbanization has also taken place in the Near East. The figures for a city in the Lebanon (its capital, Beirût) are: population in 1814, 15,000; in 1880, 80,000; in 1937, 180,000.

Emigration

In spite of the fact that the Lebanon is better off, agriculturally, than many another section of the Near East, it has led in the amount of emigration of its people to other countries.

One factor in this process has been the fact that the Lebanon has always looked toward the West and been more in contact with it than any other Near Eastern country (Thoumin, 1936: 6-7). More specifically, the Maronites of the Lebanon were a Christian minority in a Mohammedan land, ruled by Mohammedan Turks. While they partially escaped the continuous action of the social disapproval of a majority, still they realized some of its force, particularly when they attempted to spread beyond their narrow territorial boundaries. The first few emigrants, too, with their tales of undreamed-of prosperity in a new and shining world beyond the sea, would stimulate the

desire of many to pass over into that world. The failures, naturally, would be ignored, especially by young men. The relative poorness of the land, coupled with the attractions of a nonagricultural vocation in the New World, helped swell the tide of emigration. It would seem that the Lebanon had reached "saturation" (Huntington, 1945: 559), and would not support a larger population unless new techniques were to be applied. The new techniques were not forthcoming. In the mountain reaches of the Lebanon, indeed, it would be very difficult to introduce them. The poor denuded slopes have been, through the centuries, covered with terraces at tremendous cost in human labor. Lowdermilk (1944: 417) estimates that the cost in human labor of leveling terrace slopes of 50 to 75 per cent near Beit ed-Dîn (by no means so difficult an area as the northern Lebanon) at 1944 wage scales would be between 2000 and 4000 dollars an acre. And there is little room in the Lebanon for new terraces. Finally, historical events swelled the number of emigrants from the Lebanon. There were very ancient colonies of Maronites on Cyprus and in Aleppo. Cyprus, particularly, had been the first refuge of the Maronites under persecution. But the massacres of 1860 were followed by the first great historically documented emigration, that to Egypt. The insurrection of 1925-26 encouraged departures to foreign lands. About 1890 intensive emigration to lands other than Egypt began. The United States and Canada were especially favored. Today, the various countries of South America, outstandingly Argentina, Brazil, and Uruguay, are still receiving large numbers of Maronite emigrants.

One estimate makes the number of people who have left their Lebanese home equal one-sixth of the actual population (Dodd, 1940: 26); another puts at 120,000 the number of persons who left Syria and the Lebanon in the period between 1860 and 1900 alone. In the early years of the twentieth century, 15,000 a year emigrated. The world depression and new immigration laws have caused the tide to dwindle. So, in 1928, 14,228 emigrants are listed from Syria and the Lebanon; in 1933, only 2324 (Bernstein, 1936).

Maronite leaders in this country with whom I have discussed the matter estimate that more

Maronites are at present living on the continents of North and South America than remain in the Lebanon. That means perhaps half a million. Some guesses go as high as almost a million on both continents.

The "colonies" of Maronites in the various cities of the United States, from which our

series of their children was drawn, vary greatly in numbers. A sober estimate of the number of Maronites in Brooklyn is 3000. Detroit may have as many as 14,000. The smaller towns, as one should expect, have smaller, and also usually much more geographically compact, colonies.

THE AMERICAN MARONITES

The sturdy people of "Near Eastern" racial character, who left a laborious land to try their fortunes in a new world, have settled there and raised families. It is from their children that I select the subjects of the second series in this experiment in comparative anthropometry, the series I shall refer to as that of the American Maronites.

The subjects of this series were born and raised in American cities and towns: Boston, Brooklyn, Detroit, Scranton, Wilkes-Barre. None of these places affords the altitude of many of the Lebanese towns from which their parents emigrated. Being northern towns, however, their winters yield nothing in rigors to the Lebanese season. The outstanding difference between the milieu of these American Maronites and that of their parents, before emigration, lies in the fact that in the United States the habitat is cities or large towns; in the Lebanon, it was villages or small towns, founded solidly on an obviously agricultural basis.

In general, the subjects of the American Maronite series were from the ranks of the "middle class." Practically to a man, they work for their living as mechanics, office-workers, grocery-clerks, and the like. Their parents are, on the whole, moderately well off. But many of them did not enjoy this happy state at the time that our American subjects were born and received their early nurture.

During the early years of this century, the general standard of living of the average immigrant was not enviable. In some cases, crowding and its concomitant ills in the slums of our large American cities reached incredible proportions. So Wittke (1945: 439) writes: "Twenty-five years ago, there were sections of New York City, in the Sicilian district, where 1,231 people lived in 120 rooms, and

only Greeks and Syrians surpassed the Italians in the use of all rooms for sleeping purposes." The varying picture of the vicissitudes of the Syrians (a term which then included Lebanese) in America may be read in Boughton (1911) and Hitti (1924). There is, naturally, great diversity in the fortunes and occupations of the various Maronite immigrants. It is notable, however, that very many of them took up the trade of providing food for other people, as restaurateurs and grocery-men; and other large numbers became merchants, starting as peddlers, and soon working up the ladder. One factor which seems to afford a reasonable, if partial, explanation of this double fact, is that the immigrants were for the larger part men of little formal education and were at the same time independent and hard-working. A small grocery store offers an ideal situation for such men; so does a merchant career, with its inception at the peddling level.

At present, with increasing prosperity, the Maronites are in the process—rather, the process is practically completed—of moving away from the old nuclear area of the "colony" and scattering throughout the city they inhabit.

However, the coherence of the group is still marked. I believe most of the American Maronites still marry Maronite girls; but the number of marriages with non-Maronites is on the increase. This is to be expected. The American Maronites are thoroughly assimilated; few of them know Arabic well, especially to speak it.

On the whole, the customs of the households to which the American Maronites belong before they are married, are almost as American as are the customs of their homes after marriage—and these latter are completely American.

They retain some of the old Lebanese foods (and they are worth retaining, to my taste), which are interspersed throughout a typically American menu. The *khobez mar'i*, or tough and tasty mountain whole-wheat bread, is hardly seen on a Maronite table, in America; *arrak* has been supplanted by American drinks. But many of the old dishes linger on.

From the point of view of this study, the most interesting change in custom is that of the method of cradling the infant. The Lebanese Maronite custom, described at length in the preceding part of this chapter, has not only disappeared, but, so far as I can learn by questioning mothers, it disappeared from the start—exceptions to this are extremely rare.

The Maronites coming to this country from the Lebanon did not bring these cradles with them, and they had none made here. However, even though they laid their babies in an American-style crib or a bed, they still swaddled the baby to a certain extent. The mothers wrapped their infants in cloths, and laid the young ones on whatever form of bed they used.

As the comparison of cradled and uncradled heads is the particular point of this study, I naturally made extensive inquiries on this point. I feel sure that—for some reason I cannot fathom—most of the mothers of the subjects of my American Maronite series wrapped their sons more or less tightly in cloths for *two to three months*, and not for a longer period. Even when the mothers were most anxious to adopt the American way in everything and had the advice of nurses, and the like, they still adhered to this custom. The reason given: to insure straight limbs to the boy. Interestingly enough, many second-generation mothers are doing the same thing today.

The reason why I am still inclined to treat subjects thus handled during infancy as subjects with uncradled heads will develop as my study proceeds.

With regard to the rest of the customs of the American Maronites, and their milieu, little more need be said; the reader is presumed to understand that milieu thoroughly.

THE EXPERIMENT

THE PROBLEM

THE Lebanese Maronites are hyperbrachycephalic. In fact, their index, 88, surpasses that of any of their Syrian neighbors; it is itself surpassed by that of very few other peoples in the whole world (Martin, 1928: 778). In addition to this metrically expressed characteristic, they possess marked planoccipitality. Planoccipitality has long been considered as being by and large a racial characteristic (although with pronounced reservations on the part of some anthropologists, e.g., Hooton, 1946: 602).

If one were to consider the possibility that these characteristics of the Maronites had been caused by some mechanical and external factor inducing a variety of cranial deformation and were to cast about for the most likely candidate for a factor in this case, the method of cradling the infant employed by the Lebanese Maronites would immediately be given first consideration.

As will be seen from the review of the literature in Chapter IV, a variety of opinions is recorded on this very subject, that is, with regard to the effect of cradling on the head

form. Many of these opinions are to the effect that cradling does produce, in whole or part, planoccipital hyperbrachycephaly among many peoples. It is to be hoped, therefore, that a comparative approach to the problem, using the Maronites as subjects, may yield the basis for a valuable generalization.

The comparative, or experimental, approach to the problem demands two series, identical in other respects, differing completely in method of infant postnatal treatment. We have two such series, one of Maronites born and reared in the Lebanon, where the custom of rigorous cradling obtains, and the other of Maronites born and reared in the United States, where the custom of cradling has fallen into desuetude from the first. We oppose, therefore, a cradled and a noncradled series, concentrating on the variable in question.

It is necessary to produce evidence that I have removed all except one major variable in this experiment. The description of the two series, of the methods employed in studying them, of the results of this study, and of the inevitable minor variables is the task of this chapter.

THE MATERIAL

Numbers and Sex

A total of 209 Lebanese Maronites were the subjects of the Lebanese series used in our comparison. The American Maronite series numbers 180.

All the subjects of both series were males, in a normal state of health.

Age

The subjects of both series range in age from those who have completed their eighteenth year to those at the beginning of their fiftieth year. The inclusion of subjects younger than twenty-one was motivated by several considerations. It was found that more young men were available for study in the United States than older men; then, too, one should not anticipate any essential change in head form after eighteen. In the end, the average age of the

Lebanese series is 30.10 years; that of the American series, 26.28.

I feel that a slightly lower age for the American series might even be an advantage, inasmuch as it might tend to cancel out the possible increment in head length that would be correlated with the probably greater stature of the American Maronites (a probability I shall discuss shortly).

A comparison of the head measurements and indices of the various age-groups among the Lebanese Maronites (I measured a great many under twenty-one and even more over fifty, when in the field), is presented in table I. This comparison indicates that, so far as the Lebanese series is concerned, a comparison might just as validly be made with one age-group as with another. The slight and inevitable changes in the 45-x group do not enter into the discussion here.

TABLE 1: COMPARISON OF AGE-GROUPS,
LEBANESE MARONITES

	Adults (21-50)	x-25	26-44	45-X
<i>Head Length</i>				
M	176.48 $\pm$.325	177.19 $\pm$.154	176.43 $\pm$.133	175.29 $\pm$.161
σ	6.51	6.99	6.42	6.30
V	3.69	3.95	3.64	3.59
<i>Head Breadth</i>				
M	156.25 $\pm$.278	155.89 $\pm$.112	156.52 $\pm$.115	154.90 $\pm$.119
σ	5.58	5.10	5.56	4.66
V	3.57	3.27	3.55	3.01
<i>Head Height</i>				
M	130.84 $\pm$.217	131.63 $\pm$.985	130.54 $\pm$.109	132.93 $\pm$.140
σ	4.32	4.44	5.18	5.49
V	3.3	3.37	3.97	4.13
<i>Head Circumference</i>				
M	546.99 $\pm$.755	549.19 $\pm$.336	546.67 $\pm$.302	541.55 $\pm$.388
σ	15.2	15.27	14.58	15.2
V	2.78	2.78	2.67	2.8
<i>Minimum Frontal</i>				
M	105.54 $\pm$.205	105.35 $\pm$.271	105.48 $\pm$.087	107.02 $\pm$.105
σ	4.12	4.23	4.18	4.10
V	3.94	1.17	3.97	3.83
<i>Cephalic Index</i>				
M	88.43 $\pm$.219	88.13 $\pm$.924	88.44 $\pm$.086	88.84 $\pm$.109
σ	4.35	4.19	4.14	4.25
V	4.92	4.75	4.68	4.79
<i>Head Height-Length</i>				
M	74.26 $\pm$.233	74.39 $\pm$.794	73.16 $\pm$.073	75.67 $\pm$.107
σ	4.63	3.58	3.51	4.17
V	6.23	4.81	4.80	5.51
<i>Head Height-Breadth</i>				
M	83.89 $\pm$.189	84.63 $\pm$.072	83.64 $\pm$.083	85.44 $\pm$.823
σ	3.77	3.23	3.98	3.23
V	4.50	3.82	4.76	3.78
<i>Zygo-Frontal</i>				
M	75.39 $\pm$.148	75.17 $\pm$.406	75.35 $\pm$.065	75.16 $\pm$.078
σ	2.98	1.84	3.16	3.06
V	3.95	2.41	4.20	4.07
<i>Average Age</i>				
	31.66	20.3	33.1	58.4
N				
	180-184	94	106	70

Sampling

The primary area from which the subjects of the Lebanese Maronite series was drawn is very small; exactly the same remark may be applied to the American Maronite series, because the parents of these subjects came from the same area. The subjects of the Lebanese series, or the fathers and mothers of the Amer-

ican Maronite subjects, came from villages scattered throughout the Maronite land: especially from the original homeland of the Maronites, the territory of the Wadi Qadisha, with a fair number from the Kesrūan District. Those few who were born outside of the Lebanon were carefully interrogated about their family history, which, as I have remarked,

they knew. The total number of towns from which the Lebanese subjects came was forty-one; for the American series, the total is fifty-six. The distribution of these towns is casual, and the same cultural and "national" area is covered in both series. These are minor considerations which I shall not present at length here. For instance, the custom of transhu-

mance, mentioned in Chapter I, makes it difficult to be sure whether people come from one or the other of two towns, since their parents spent the winter in the first and their summer in the second.

We have here, then, a comparison of two general groups, drawn from the same cultural and "national" larger group.

THE TECHNIQUE

Selection of Subjects

In addition to the principle of sampling described, i.e., the cultural and "national" one, and in addition to the usual criteria applied to subjects of an anthropological study, such as age, normal good health, the final and critical norm of selection of subjects for the American Maronite series was that of the method of infant bedding which they experienced.

In determining the method of cradling, I showed the subjects photographs of the Lebanese method in action (fig. 3), and asked whether their younger brothers and sisters had been so treated, or whether there was such an object as the cradle in the attics of their homes. Elder brothers, when present, were asked about their younger brothers, who were being studied.

But the most effective information, as one should anticipate, came from the mothers of the subjects, who were questioned about the cradling of their sons, whenever possible. Almost as effective was the information elicited from the female neighbors. Particularly in the early days of intensive immigration into the United States by the Maronites and during the time when the subjects of the American series were being born and raised, the Maronites lived in compact enclaves in the locality. Nothing was secret from the neighbors, and, of course, there were always aunts, even more knowledgeable than neighbors.

With regard to the subjects studied in the American Maronite series, I can rule out the Lebanese cradling custom with certitude.

There remained, however, the variant mentioned in the first chapter, i.e., swaddling of short duration. The infant is swaddled and laid in the crib, thus wrapped for the first two or three months of its life. All the informants

were clear on the point of time; this practice never is employed longer than the first three months. I am of the opinion that little or no deviating effect could be expected to manifest itself as a result of this custom, since it renders the infant immobile precisely at a period of its life when it would be helpless and usually reclining on its back, even if not so constrained.

Technique of Observations and Measurements

OBSERVATIONS

In studying the Lebanese series, I made use of the Harvard Anthropometry blanks (Hooton, 1946: 750-51). The observations pertinent to the problem we are studying here were: (a) Occipital Flattening, Abs., +, ++; (b) Occipital Protrusion, Abs., Sm., +, ++; (c) Lambdoidal Flattening, Abs., Sm., +, ++; (d) Cranial Asymmetry, Abs., Left, Right. At the time these observations were made, no special attention was being paid to the problem of occipital flattening, otherwise a more detailed scale should have been devised and used.

Before studying the living Lebanese Maronites, I investigated some 254 skulls of both sexes, from Maronite cemeteries of the Lebanon. The records of this study were lost during the war. But it is remembered that in the study of the skulls, a distinction was perceived and recorded between occipital flattening of a "hinged" or "slanting" nature, which was, as it were, hinged on the iniac region and the lowest part of the occipital bone above the iniac ridge and slanted forward to the obelionic region, and a "straight" flattening, which projects upward from the iniac ridge, in a plane perpendicular to the Frankfurt and the median

sagittal planes. This distinction will receive attention in a few pages.

In studying the American Maronite series, I found it useful to estimate and locate flattening by palpation. The hand is first placed on the head so that the thumb encounters one tuber parietale, the fingers the other. This operation always gives one an initial suspicion of flattening or normality, after acquisition of experience of the specific group involved. The other hand is placed against the back of the head (or the same hand is slid downwards) and is moved from the obelionic region to the nuchal musculature. Any peculiarities discovered are further investigated with the finger tips. Therefore, I should add the hand to the statement of the craniologist, His (1864: 10), that "das Auge der sicherste Führer ist und . . . der Massstab erst als kontrollierendes Hilfsmittel nachfolgen kann."

The only other observations made on the American Maronite series, beyond remarks on anything out of the ordinary, were those on eye color (taken without a scale), and hair color, taken (as in the case of the Lebanese series) with a Fischer-Saller scale.

MEASUREMENTS

The usual instruments were employed in taking the measurements. The spreading and sliding calipers were the same models in both instances and were standard type. The head height, unfortunately, was measured according to two techniques. For the Lebanese series, Hrdlička's method with two calipers (Hrdlička, 1947: 89-92) was followed, but the calipers were held up fairly firmly and the height in a plane perpendicular to the Frankfurt plane was taken, instead of the height at bregma. For the American series, Todd's Head Spanner, also firmly held up, was used.

Even though approximately seven years had intervened between the study of the Lebanese and that of the American series, every attempt was made to maintain a similar technique. Since the Lebanese series was measured immediately following on a study of the Maronite skulls, I was particularly conscious of a desire to approximate the skull measurements when measuring the living, consequently my technique was more than ordinarily heavy-handed. This same heavy-handedness was em-

ployed on the American Maronites. As much pressure was applied as the subject could bear, without pain. This was particularly the case in taking the bigonial diameter; the attempt to get as close as possible to the bone was vigorous. Consequently, all my measurements are probably somewhat smaller than those which another operator might obtain. However, every conscious effort was made to keep the personal factor steady for the two series.

I shall now discuss the individual measurements.

Head Length. This was the maximum length, glabella to opisthocranium, in the median sagittal plane (Howells, 1937: 492; Hooton, 1946: 757-58). In the case of the most severely flattened of the Lebanese heads, this measurement sometimes became largely a matter of judgment, since the length was pretty much the same over a large area of the posterior part of the head. As a matter of fact, often the lambdoid region or above it would have offered a greater length. However, I was prepared for this phenomenon by the study of the skulls and restricted the area of application of one point of the calipers to the occipital.

Head Breadth. The maximum breadth of the head, above the level of the ears (Hooton, 1946: 758).

Fortunately for this study, these two measurements are the essential ones, and at the same time they offer the possibility of suffering the least variation.

Head Height. The two methods employed, that of Hrdlička and that of Todd, have been compared by Todd (1925) on cadavers, and by Gray and Jacob (1928) and Goldstein (1938) on the living (schoolboys). On the whole, the two methods yield not widely differing results. As Howells (1938: 193) says, "In each case the standard deviations yielded by Hrdlička's method were somewhat larger, though only Todd considered the difference to be of any significance." I am not as satisfied as Howells seems to be with the situation; still, I doubt that the results are noncomparable to an extent that renders a reporting on my findings in the two series completely useless. I made every effort, in using Hrdlička's method, to exert a firm, gentle pressure upwards on the calipers, and especially to keep them in a plane perpendicular to the Frankfurt plane.

Head Circumference. The horizontal head circumference, commencing at the glabella and going around the head as nearly as possible in a plane parallel to the Frankfurt plane.

Minimum Frontal. This measurement was taken at the customary points, with the same strong pressure characteristic of the other measurements.

Bizygomatic. The same remark applies to this measurement.

Bigonial. As mentioned before, special effort was made during the taking of this measurement in order to approximate the skeletal gonion.

Total Face Height. The height of the face, from nasion to menton, with moderate pressure being exercised on the menton region. The nasion was located by a combination of palpation and the method of Ashley-Montagu (1935), and lightly marked with a thumbnail.

Upper Face Height. Following the technique employed in the original Lebanese work, this measurement was also registered on the American series from nasion to a point approximating the bony prosthion, rather than the fleshy one.

In all this, it will be seen that I followed Martin (1928: 180 ff.) closely.

THE RESULTS. THE DATA OBTAINED FROM THE EXPERIMENT

The Observational Results

The occipital flattening among the Lebanese Maronites, as I have already noted, was of two types: a "hinged" type, and a "straight" type. These types are not, of course, mutually exclusive, nor does my isolation of these types indicate that I ignore the complete series of transitional flattenings that occur. However, the attention given to these two end-types will have its fruits, I hope, in a better understanding of the relations of flattening to the metrical data, and of the relations of lambdoidal to occipital flattening.

The "hinged" flattening, viewed in normalis, is illustrated in the photographs of the skulls from Alkali Ridge (fig. 4, *a*, *b*). Through the kindness of Dr. J. O. Brew, and the Peabody Museum, Harvard University, I am allowed to use these photographs, which have already appeared in the publication on Alkali Ridge (Brew, 1946). A sketch of a Maronite skull, used as an example of a deformed skull, is given in his *Éléments* by Topinard (1885: 745); and several skulls so deformed are illustrated in Hooton (1930) and Newmann (1941: fig. 3). This "hinged" flattening is pretty much what Stewart (1940) calls lambdoidal deformation, and he, too, illustrates Indian skulls from the Whitewater District, eastern Arizona.

The point of this "hinged" flattening is that, when high, restricted to the lambdoidal region alone, and small, it may easily be passed over

as merely a lambdoidal flattening. No observations, for instance, were made by Hrdlička (1908) on such flattening among Indians of the Southwest. Yet this deformation can, and does in many cases I have observed, also affect the measurements of the skull, specifically the breadth. I can well conceive of its also affecting the length, even to increasing this diameter. But not only is the breadth generally found to be the more variable character (Martin, 1928: 767), but the excessive projection of the tubera parietalia is quite observable on many skulls suffering from nothing more than a good, strong lambdoidal flattening. I am by no means saying that all lambdoidal flattening is a deformation, since I am in no position to make that statement at this juncture. But *some* lambdoidal flattenings are deformations, and some are large. It is interesting, in this connection, to compare the photographs of the Alkali Ridge Indians with the first of my photographs of Lebanese Maronites (fig. 4, *c*, *d*). Later I shall indicate how these deformations were created.

It is of some importance to the head length whether this "hinged" flattening invades the occipital bone area, or stays mostly above it, in the lambdoidal area. It can, on occasions, descend far, and still leave a small, but sharply protruding curve of the occipital bone between it and the torus.

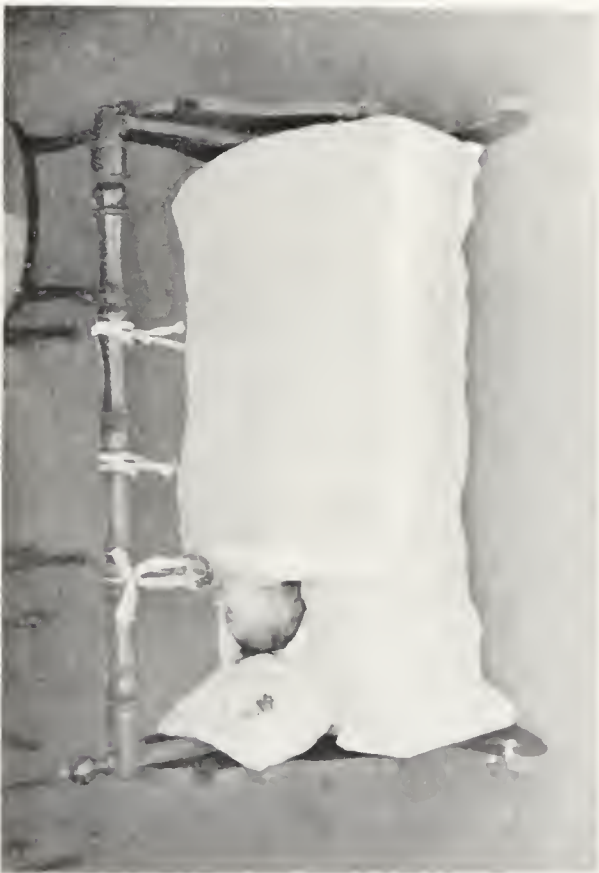
It is rare that one finds a "straight" flattening, absolutely and mathematically fulfilling the requirement of forming a plane parallel to



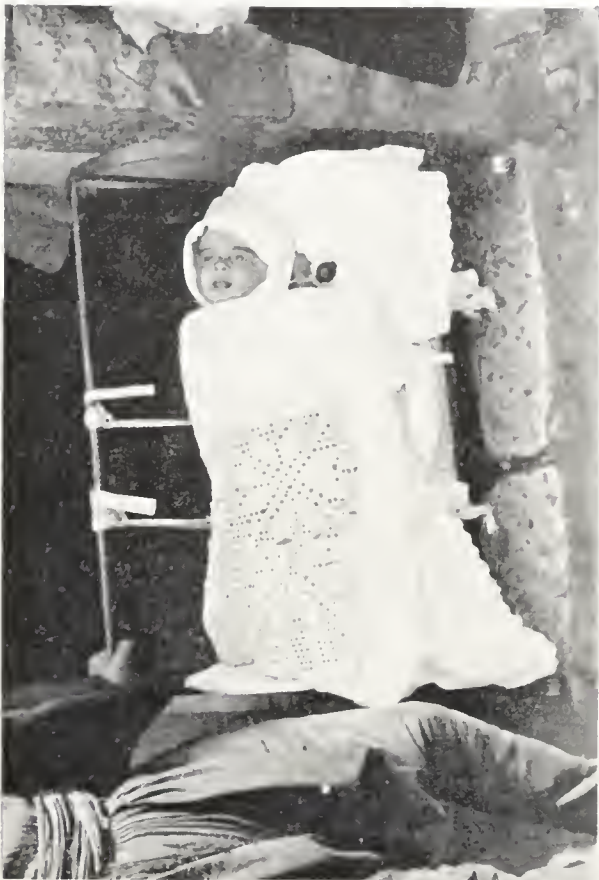
a



b



c



d

a, A typical cradle. b-d. Three Lebanese Maronite infants, cradled.

*a**b**c**d**e**f*

a, b, Alkali Ridge skulls, showing deformation—"hinged" flattening. *c, d*, Two Lebanese Maronite subjects, showing "hinged" and "straight" flattening, respectively. (Cephalic index of both, 88.) *e, f*, Two American Maronite subjects. (Cephalic index of both, 79.)

the median transverse plane, and perpendicular to the Frankfurt plane. However, from the point of view of the effect made on the metrical data, how much the flattening invades and presses in the occipital bone is important. A contrast between the two types is presented in the first and second of the two photographs of the Lebanese Maronites (compare Newmann, 1941: figs. 3 and 4). These photographs were selected because both subjects had a cephalic index exactly the average for the Lebanese series, but showed different types of flattening.

The Lebanese Maronites as a series had occipital flattening to the following degrees: Absent, 2.17 per cent; +, 29.89 per cent; ++, 67.93 per cent. Lambdoidal flattening was: Absent, 95.11 per cent; Small, 3.26 per cent; +, 1.63 per cent. If I were reviewing these heads, I should make a different record today, especially with respect to categories. My impression is that the majority of the flattenings labeled "Occipital" invaded the occipital region seriously; and this impression is corroborated by the observation of the Lebanese Maronites encountered while I was studying the American Maronites. This invasion of the occipital region is also borne out by the metrical data, and the cephalic index, 88 for the living and 87 for the skulls of the Lebanese Maronites. However, I may well presume that the cephalic index would have been even higher, had all the flattening been of the "straight" variety. That lambdoidal deformation, or high "hinged" flattening, affects the cephalic index, is clear from the work of Hooton (1930) and, lately, that of Seltzer (1944) and Stewart (1940), all on ancient Indian skulls, and Hrdlička (1908) on living Indians.

The heads of my American Maronite series appeared very different, both to immediate and casual observation, and in tabulated observation, from those of their immediate ancestors. These heads showed 61.3 per cent of lambdoidal flattening. All of this flattening was small and well localized around lambda, except for 2.5 per cent which invaded the uppermost border of the occipital region. These latter were all found on the heads that had the highest cephalic indices of the series. Only one real case of almost "straight" occipital flattening was found. This subject, on

being interrogated, testified that he always slept on his back; and his mother added the information that her son had slept on his back continuously from the first days of his infancy on, and had resisted all her efforts to get him to assume another position in bed.

The occipital protrusion among the subjects of the American Maronite series is typically strong and always quite normal (fig. 4, e, f).

I did not record all the asymmetries found on the American Maronite heads, but their number was very small indeed. Interestingly enough, the Lebanese Maronite series had the following percentages of cranial asymmetry: Absent, 80.43 per cent; Right, 10.33 per cent; Left, 9.24 per cent. On the basis of the observations of others, I should expect greater percentages. Pokrowskj (1900) concludes from his examination of skulls from cradling groups that the chief effect of cradling is cranial asymmetry (compare Field, 1948: 146). Le Gros Clark (1934: 50) remarks that asymmetries of the outer skull are, or at least can be, independent of asymmetries of the dural sinuses and the occipital lobes; i.e., the outer asymmetries should be mostly of external origin. There may be hereditarily conditioned asymmetries, also; at least, Weiss (1926: 263) describes two types he calls hereditary: one, a flattening of the right parietal in the rear, with an arching of the same bone anteriorly, and associated changes in near-by bones of the skull; and the second, a flattening of the left parietal, with a bulging out of the left frontal. Weiss (p. 262) claims these particular asymmetries are contracted during early fetal months. Frommolt and Caffier (1927: 53) observe much the same asymmetries: in general, a flattening of one parietal, an outward arching of the other, often with a reverse effect on the frontal bone. They opine (p. 57) that many asymmetries may be hereditary. I am suspicious of all this, to put the matter mildly. There are cranial asymmetries in all anthropoids (Leisewitz, 1906), but it remains to be proven that a particular asymmetry is actually hereditarily induced. Martin (1928: 743) holds that some asymmetries are inherited, but many are caused by external factors.

At all events, no one has ever even mentioned occipital flattening as possibly a hereditary asymmetry or deformation; some obstetricians (as we shall see in Chapter IV) have

associated a "Dinaric"-shaped head with certain positions in the uterus of the fetus, and with certain presentations. That is all.

The low percentage of asymmetries among the Lebanese Maronites is, so far as I can see (and anticipating my final verdict on occipital flattening), the result of efficient cradling on the part of the parents during the infancy of the child.

This digression on asymmetries aside, I wish to put down plainly the result of the observations pertinent to our problem on the two series of heads: the two kinds of heads are *totally different types*.

The Lebanese Maronites head is flattened in the back, the post-auricular length is abnormally short, the head has a "sugar-loaf" shape (Hooton, 1946: 602), typical of the Dinarics or Armenoids. There is usually a marked occipital torus, corroborating Hooton's (1930: 91) remarks on the Pecos Indians. Often, the head rises to a peak, or, better stated, the posterior plane of the head drops abruptly from a point well above lambda.

The American Maronite head is longish, moderately broad, fairly high; the post-auricular length is not remarkable for shortness or for great length; the occipital protusion is as normal as it is absent among the Lebanese. Quite generally, there is a definite lambdoidal flattening.

These differences are fairly well brought out in the photographs which compare Lebanese

and American Maronite heads (fig. 4, c-f). These particular photographs were chosen because the subjects, Lebanese and American, possess the metrical average cephalic index for their two groups. The contrast would be, of course, still more striking in many other subjects.

The Metrical Results

Although more detailed subdivisions of the metrical data, e.g., according to types of flattening, might be desirable, still the comparison of the two series, each as a whole, is sufficiently striking. The metrical data confirm the conclusion from the observations; namely, that the Lebanese and American Maronite heads belong to two very different types.

These data are presented in table II.

One sees at first glance that the heads of the two series are startlingly different in head length, less so in head breadth, and very much less so in head height. The head circumference, as one should expect, changes considerably, following the head length. In the case of the cephalic index, it is the length that makes all the difference; the same statement holds true for the head height-head length index. In the face, the great change is in the bigonial. The facial index is not so markedly different, and the upper facial index is approximately the same. After these few very general remarks, we turn to the more detailed discussion of the data.

DISCUSSION OF THE RESULTS OF THE EXPERIMENT

Since the observational data need little more elucidation, I turn immediately to the metrical data.

Head Length. The head length varies the most of any measurement — a situation which is not unexpected in a comparison of a series exhibiting occipital flattening with one that shows normal occipital protrusion. The Lebanese Maronite head is shorter than its American counterpart by 13.555 millimeters. The x p.e. of the mean head length of the two series is 30.09 — a tremendous one.

This difference is greater than that found in any other study dealing with immigrants and their offspring, which has come to my attention.

The initial and well-known study in such a comparison was made by Boas (1911). In order to keep the relations of his findings to our own applicable, I consider only the differences noted among adult subjects. The greatest difference in the cephalic index was 2.5 points; this obtained for the combined series of Bohemians, Slovaks, Hungarians, and Poles, at the age of twenty-one, with 11 and 13 subjects, respectively, representing the foreign-born and the American-born. In this case I am particularly inclined to suspect differential infant treatment. In fact Boas himself later (1912: 554) wrote a sentence that could serve as the motto for this study: "I consider a further investigation into the influences of the

TABLE II: COMPARISON OF SERIES
MEASUREMENTS

		LEBANESE MARONITES	AMERICAN MARONITES	X P.E.
Measurement				
<i>Head Length</i>	M	176.84 ±.312	190.395 ±.325	30.09
	σ	6.66	6.29	
	V	3.77	3.301	
<i>Head Breadth</i>	M	156.26 ±.253	151.777 ±.300	11.42
	σ	5.42	5.817	
	V	3.47	3.83	
<i>Head Height</i>	M	131.03 ±.233	129.08 ±.251	5.68
	σ	4.95	4.76	
	V	3.78	3.69	
<i>Circumference</i>	M	547.84 ±.701	567.515 ±.850	17.86
	σ	14.97	15.585	
	V	2.73	2.75	
<i>Minimum Frontal</i>	M	105.52 ±.190	107.18 ±.212	5.82
	σ	4.06	4.072	
	V	3.85	3.80	
<i>Bizygomatic</i>	M	140.205 ±.224	139.515 ±.299	1.85
	σ	4.79	5.685	
	V	3.42	4.07	
<i>Bigonial</i>	M	110.04 ±.268	105.356 ±.310	11.43
	σ	5.74	5.95	
	V	5.22	5.65	
<i>Total Facial Height</i>	M	122.33 ±.282	125.15 ±.360	6.17
	σ	6.04	6.915	
	V	4.94	5.53	
<i>Upper Facial Height</i>	M	70.78 ±.207	72.18 ±.245	4.36
	σ	4.43	4.69	
	V	6.27	6.50	

INDICES

Index				
<i>Cephalic</i>	M	88.28 ±.206	79.17 ±.189	32.58
	σ	4.39	3.74	
	V	4.97	4.73	
<i>Head Height-Length</i>	M	74.19 ±.167	67.36 ±.154	30.06
	σ	3.53	2.95	
	V	4.76	4.37	
<i>Head Height-Breadth</i>	M	83.93 ±.177	84.42 ±.185	1.91
	σ	3.74	3.498	
	V	4.46	4.14	
<i>Fronto-Parietal</i>	M	67.79 ±.136	70.14 ±.165	10.99
	σ	2.90	3.14	
	V	4.28	4.47	
<i>Cephalo-Facial</i>	M	89.75 ±.151	91.595 ±.199	7.43
	σ	3.24	3.77	
	V	3.61	4.11	
<i>Zygo-Frontal</i>	M	75.49 ±.140	76.37 ±.140	4.45
	σ	3.00	2.67	
	V	3.98	3.49	
<i>Fronto-Gonial</i>	M	104.08 ±.280	98.16 ±.297	14.504
	σ	6.00	5.70	
	V	5.76	5.81	
<i>Zygo-Gonial</i>	M	78.58 ±.171	75.15 ±.206	12.81
	σ	3.67	3.92	
	V	4.68	5.22	
<i>Total Facial</i>	M	87.57 ±.256	89.39 ±.283	4.77
	σ	5.47	5.36	
	V	6.25	6.00	
<i>Upper Facial</i>	M	50.57 ±.161	51.02 ±.180	1.86
	σ	3.43	3.399	
	V	6.79	6.66	

method of bedding children desirable." In the age-class of twenty-six years and over, the difference in the cephalic index was 0.4 points, with 706 and 61 subjects, respectively, foreign-born and American-born. The Jews, foreign-born and American-born, differ by 1.6 points, the American-born being longer-headed. There are no adults in the Sicilian and Neapolitan groups. Boas, at the time (1911: 49), did not think that the methods of bedding the infant entered into the interpretation of his results. The peoples he investigated should be reworked, with more variables removed; infant treatment is one of the variables that should receive accurate attention.

The results of Boas' work were criticized by many, among the critics being Pearson and Tippet (1924). They found that English boys did not change in cephalic index from 4.5 years to 20.5 years of age (girls changed slightly) and concluded that the cephalic index was still a stable phenomenon in the anthropological cosmos. They also pointed out (p. 138) that the cephalic index of Jews all over Europe, in the most diverse environments, was stable; they could not believe that such a short time in the new environment of the United States could work any essential change. Morant and Samson (1936: 31) concluded that larger differences would have to be found in order to establish the theory that head form, as indicated by the cephalic index, was modified directly by environment. Auerbach (1912) pointed out that the cephalic index in Boas' subjects changed with the stature.

However, other workers have also found changes as between immigrants and their offspring. Guthe (1918: 223), for instance, registers a difference of -0.77 points in the cephalic index for males, comparing Russians born in Russia and in America. This is not an impressive contrast.

Two authors have studied the Japanese. Spier (1929: 7) obtains head lengths differing by as much as 3.4 millimeters among Japanese born in Japan and those born in the United States. His greatest difference in the cephalic index was 5.5 points, at the age of eight. I can not help suspecting that some disturbing external circumstance has entered into the picture. I say this in the light not only of other similar studies, but in that of my own findings

and of all the literature I shall cite before the end of this investigation.

Shapiro (1939) observed a difference in head length between Japanese born in Hawaii and in Japan, those native to Japan being longer by 1.84 millimeters. The x p.e. between the head length of Hawaiian-born Japanese and the immigrants from Japan was 6.31. The difference in cephalic index was 2.6, being greater in the case of the Hawaiian-born Japanese; the x p.e. was 11.0. None of these differences, although notable in themselves, approach in magnitude the contrast I find between my Lebanese and American Maronites.

For Appleton (1927: 250), Chinese boys in Hawaii showed a difference in cephalic index of +0.13 over Chinese in Chekiang, and exactly the same over Chinese in Kiangsu, at the age of eighteen. Her numbers were small: 11 for Hawaii, 11 for Chekiang, and 15 for Kiangsu.

Goldstein (1943: 37) found no significant difference in the cephalic index of Mexican parents born in Mexico, and their children born in the United States. As for head length, American-born sons were 0.5 millimeters longer, on the average, than their Mexican-born fathers. Although I am restricting myself, as a rule, to evidence from male subjects, it might be mentioned here that the U. S.-born daughters of the Mexico-born mothers had a head length 2.1 millimeters shorter than their mothers.

Hirsch (1927: 81-83, 88) corroborated Boas' work on Jews, finding that the cephalic index was lowered 2.5 to 3 points, with a concomitant lengthening and narrowing of the head. I am definitely inclined to suspect infant treatment as entering into the picture here—in addition, naturally, to other possible factors, such as increased stature.

Finally, to bring this brief review of other findings concerning the comparison of immigrants and their descendants to a conclusion, we note that Boas (1924: 79) made a brief study of Armenians. This interests me very much, since the Armenians are cognate to the Maronites in their cradling customs. Boas, indeed, found a great decrease in the cephalic index between the two groups, and concludes that the difference in cradling was an essential point. I shall discuss this work more in detail in Chapter IV.

The combination of my findings with those of Boas creates, I think, the strong probability that some such disturbing factor as difference in cradling customs entered into the production of the large difference found by Spier in the Japanese.

But the point must be emphasized that no other series shows such a great difference, attributable to that mysterious factor called "environment," as do my Lebanese and American Maronite series, and here the difference is clearly due to one major variable. Even if I should whittle down the magnificent difference in head length and cephalic index exhibited by my two series, and remove one or two points of the index-difference because of difference in "environment," I still have a very large disparity indeed.

This difference is all the more striking, when I compare the change in head length with that in head breadth. The latter changes absolutely and relatively little. The effect of cradling on the Maronite head is primarily to reduce the length; this statement also holds, when I consider the head height. Both these measurements will be regarded with greater scrutiny in a moment.

Several other possible reservations conceivably affecting the sharp focus of the picture presented by the metrical data with regard to the vault measurements and especially the head length must be examined here.

The first of these is the correlation of head length with stature. That such a correlation exists, within given populations, has been quite generally established by various authors, working on various groups. Martin (1928: 783) mentions Germans, the people of Baden, Tirolese, French, Russians, Italians, Swedes, Gypsies, and Papuans. Pittard (1905; 1911; 1935; Pittard and Donici, 1927) makes a great deal of this phenomenon in numerous papers. Johannsen (1907: 183) emphasizes the point that this greater tendency towards dolichocephaly exhibited by the taller subjects is due to the greater absolute head length of these taller people. Certainly in an accurate and complete study of a population, the relationships of stature and head length should not be disregarded, although many of the correlation coefficients are small, and the picture may often be confused (Sacchetti, 1942).

Exceptions to this tendency have occasionally been noted. The most interesting I have seen is that of de Froe (1938: 29), who worked on Dutch skulls, which were documented with cadaveric length, sex, etc. He finds that cadaveric length correlates very poorly with skull length and breadth, although well with various measurements of the skull base, and concludes: "We zien dus, dat het schedeldak d.i. het grootste deel van den beenigen hersenschedel, zich onafhankelijk van de lichaamslengte ontwikkelt." Hrdlička (1935: 288) finds that the head length is somewhat increased with increasing stature, though not proportionately. It does not keep pace with stature in Egyptians and Old Americans. Saller (1930: 49) has some interesting figures for his Fehmarn male subjects: the correlation coefficient for stature and head length is 0.291; for stature and head length arrayed according to percentages of stature, -0.53; for stature and head breadth, 0.24; for stature and cephalic index, -0.05. The last figure is very important.

The correlation coefficient for stature-head length among the Lebanese Maronites is 0.194, not an impressive one. Unfortunately, I have no data on stature for the American series. But the probability that they are somewhat taller than their parents is strong. An increase of stature in American-born of various groups over that of their ancestors has been found by Boas (1911) for Jews, Bohemians (but not for Italians); by Fishberg (Morant and Samson, 1936) for Jews; by Spier (1929) and Shapiro (1939) for Japanese in America and Hawaii; by Appleton (1927) for Chinese.

That some of this increase in stature is connected with betterment of social and dietary conditions is proposed at length (with much literature) by Sanders (1934: 219-95). I do not think that the probably existing increase in stature of American over Lebanese Maronites would be extremely marked, if these causes alone were operative. The conditions of life for the immigrants when the subjects of my American series were born and raised were not too favorable. Rural people are generally taller than urban folk: the Maronites are urban to a man. The well-to-do are taller than the less well-to-do; my Maronites are variable in this respect, but I hazard the opinion that the majority were less well-to-do

twenty-one to fifty years ago. The professional class is taller than the middle class: my Maronites are not notable for an excess of professional men. There is no reason to attribute to them a state of health markedly better than the average. Nor, finally, do I have any reason to suspect that the percentage of ectomorphs suddenly became overwhelming among them.

In any case, even if the American Maronites are somewhat taller than their Lebanese ancestors, this fact would not endow them with a markedly greater head length or lower cephalic index. The differences between different stature-groups in the investigations cited do not extend, *at their greatest*, to more than two points in the cephalic index. The average stature of the Lebanese Maronites puts them in the medium-tall category (160.0–169.6 centimeters). An increment of even 2 centimeters (and I doubt, from observation, that the gain would be that great), would merely carry them into the tall category, with a probable change of a digit behind the decimal point in the cephalic index. Certainly, increase in stature could never be in any way correlated with the tremendous difference I obtain, precisely in head length and cephalic index (compare magnitudes in Sacchetti, 1942), not elsewhere.

Even if I were to consider reducing the magnitude of the difference I obtain in head length and cephalic index, I should not have to reduce it anew for each of the variables I am here considering, since they all fall under the heading of that catch-all category, "environment."

So, too, in some part, does the difference observed by some between dwellers in the country and in the city. Ammon (1899) found that the Baden people in the cities were more dolichocephalic than those in the country. Could infant treatment also enter into the process? Pessler (1939: 227–28) found differences, but not impressive ones: the head, in the cities, is 0.7 millimeters shorter, and 0.9 millimeters narrower, the cephalic index, 1.2 points lower. He also found (p. 247) that the children of both city and country groups were more dolichocephalic than their parents; however, the children differ more from their parents in the country. Not all the differences he found are statistically significant, but they all

point towards an action of some kind on the head form by "city life." Pessler (p. 248) advances some very tentative hypotheses for explaining this phenomenon: earlier puberty and quicker growth among them; Martin (1928: 792) is content to leave the whole thing to "Selektive Prozesse."

The influence of food is no doubt also to be included among the variables. The work of Iwanowsky (1925) on famine-sufferers, and various experimental work on animals, will be discussed in Chapter IV. For the moment, I shall only remark that the food in the Lebanon is adequate, but as a rule simpler than in America. In the absence of accurate data, such as weighed and analyzed meals, I can say little more.

There is no rampant disease among the Lebanese Maronites which could, by any stretch of the imagination, explain their flattened occiputs by its presence, and, by its absence, the normal heads of their children in America. Some idea of the diseases which are common in the Lebanon is afforded by the official government statistics (*Recueil de Statistiques*, 1942–43: 54). This source is rendered less than ideally useful by the fact that physicians are not required by law to turn in records of their cases to the Government, but may do so if they wish. With this proviso in mind, we note that the most common contagious diseases occur in the following order, according to frequency of incidence: trachoma, typhoid and paratyphoid, smallpox, dysentery, scarlet fever. The causes of death listed in the same way are (p. 58): (not specified), diseases of the digestive apparatus, diseases of the circulatory apparatus, of the respiratory apparatus, senility, infectious and parasitic diseases, genito-urinary diseases, cancer and tumor, rheumatic-nutritional-endocrine diseases, children's diseases. It seems very possible to me that better infant and subsequent hygiene here in America has allowed the persistence in life of a number of ectomorphs, who add considerably to the average stature of the American Maronites. But I cannot, at the moment, substantiate this opinion.

To sum up: The vast difference in head length and cephalic index and head form between the Lebanese and American Maronites can be conceivably lessened to a minor degree

by one or more of the variables I have discussed. But there is only one factor that can claim to have created that great difference — the fact that the Lebanese Maronites were cradled during infancy in the traditional manner, and the American Maronites were not so treated.

With regard to this cradling, we still have one final variable to consider. I have mentioned the custom, among the American Maronites, of swaddling the infant for two to three months after birth. I was worried by this practice, at first. However, I finally came to the conclusion that this custom made little or no difference. The reasons for this conclusion were two: the fact that the Detroit subjects (in Detroit the custom is admittedly universal, even in the second and third generation) had even a slightly lower cephalic index and head length than the other American Maronites; and secondly, the strong probability that many American-born children of other extractions are somewhat affected by ordinary bedding during the first months of infancy. The basis for this second reason will be found in the literature I shall discuss in Chapter IV.

Head Breadth. The difference in head breadth between the Lebanese and American Maronites is only 4.48 millimeters. The *x p.e.* is 11.42 — large, but not comparable in magnitude with that of the head length. It is interesting to note that Melconian and Schaepelynck (1947: 50) also found the principal difference to be in the head length, when they compared their small series of "normal" and "deformed" skulls from the Lebanon.

It is possible that the lambdoidal flattening observed on so many of the American series has something to do with this "retention" of head breadth, but I am not prepared to state this as a fact. I doubt that the effect of this small, localized flattening is marked.

It is interesting, if merely speculative, to note that, if one were to construct an ellipse whose long axis were the average head length of the Lebanese Maronites, and the short axis their head breadth, and were then to lengthen the long axis to the head length of the American Maronites, but keep the area unchanged, the short axis would be only 143.7 millimeters, instead of the actual head breadth of the

American Maronites, of 151.7 millimeters. Compensation obviously does not occur in the areas registered for us by the ordinary measurements.

However that may be, the head breadth, although extremely variable within a group (Tschepourkowsky, 1911; Pearson, 1897) as a rule, appears to be a sober diameter, considered with regard to growth. So Weissenberg (1908: 315) writes: ". . . nicht alle Teile sich gleich intensiv entwickeln, indem auch in dieser Beziehung die Kopfmasse die geringere und die Gesichtsmasse die stärkere Zunahme zeigen. An den Polen stehen die Kopfbreite mit der geringsten Wachstumsenergie, und die Nasenhöhe mit der stärksten." And Vilas (1929: 712): "Die grösste Länge nimmt während der Entwicklung, entsprechend der Beständigkeit des LBI, verhältnismässig stärker zu als die grösste Breite." An idea of the interracial variability of head breadth can be gained from the fact that its range is 72 millimeters (Bartels, 1904). Martin (1928: 767) attributes brachycephaly primarily to the greater breadth of the head, at least for the majority of brachycephals. This fact will reappear in another context in Chapter IV. The point I want once more to make here is that in the case of the Lebanese compared with the American Maronites, it is not the head breadth but the length that makes most of the difference.

Cephalic Index. It is the head length that primarily affects the extravagantly divergent cephalic indices for the two groups, between which we have the exorbitant *x p.e.* of 32.58. In a small series (*N*: 25 each) of fathers and sons, whose head lengths and breadth I recorded while studying the American Maronite series, I obtain a similar result: of these twenty-five, the sons (American-born) yielded an average cephalic index of 78.7, the immigrant (Lebanese) fathers, one of 89.2.

Head Height. The rather small change in head height is surprising, especially when one recalls the impression of hypsiccephaly given by many Maronites of the Lebanon. Melconian and Schaepelynck (1947: 51) found increased head height in a small group of "deformed" as opposed to "normal" Lebanese skulls. But even allowing for the deplorable difference in techniques employed on the two groups, the results may indicate that the differ-

ence in head height may not be so striking, in large series, as one should expect. I am in a position to propose only tentative opinions on this subject, but these opinions are: (a) measurements of two series like mine with the same technique would show a greater change in head height, and (b) this change would not be the startling one anticipated. The reason for the second opinion is the result of numerous morphological observations on Lebanese Maronite skulls and living heads to the effect that in planoccipital subjects there is considerably more fullness in the supralambdoidal region. Much of the compensation, therefore, would occur in the very rear of the head, posterior either to bregma or vertex. Another area of compensation would be the descended posterior cranial fossa. That a down-curving of the lower occipital bone takes place in hyperbrachycephalic skulls has been noted by craniologists, and has entered medical literature, in connection with landmarks of the head and neck. Thus, Goldhamer and Schuller (1927: 1175), dealing with Austrian skulls, remarks on the deepening of the "hinteren Schädelgrube," in the case of hyperbrachycephals. I have observed this same effect myself, in studying a number of X-rays of Maronite heads at the Medical School of the American University of Beirut, through the kindness of Dr. Richard Kegel.

On the whole, the trend of my present opinion—that the deformation of occipital flattening affects largely the rear portion of the head—is consistent with the findings of a number of craniologists. I shall discuss their findings at length in Chapter IV, to which chapter I should like to confine consideration of the literature.

Head Circumference. This measurement adds little important knowledge to our survey of the comparative situation of Lebanese and American Maronite heads. The x p.e. between the two means, 17.87, is large enough, to be sure, although little more than half of that obtained between the head lengths. This measurement primarily reflects the shortening of the head due to flattening.

Minimum Frontal. We should consider, in addition to the essential discussion of the vault dimensions, a subsidiary set of remarks on the face. In this section, I have three background ideas: (1) the racial continuity or dis-

continuity between the two types; (2) any changes that might reflect differences in environment; and (3) any changes which would reflect the influence of occipital flattening.

The first measurement I shall consider, the minimum frontal, bridges, as it were, the discussions of the head and the face. The difference between the two series with respect to this measurement turns out to be an intriguing one, especially when compared with the other brain-case dimensions and with those of the face.

The American Maronites have a broader minimum frontal, being larger by 1.66 millimeters in the mean. The x p.e. shows a significant difference (it is 5.82); I can see no reason why this should be the case. Nor am I unduly concerned about the significance. Certainly, occipital flattening does not noticeably affect the forehead, in so far as the forehead may be characterized by the minimum frontal measurement. Both the present fact and my observations do not agree with the conclusions of Pruner-Bey (1866: 566), who stated that flattening had changed Syrian skulls from dolichocephaly to hyperbrachycephaly, and had also forced out the forehead (made it "bombé") and increased the width across the zygomatic arches. Hooton (1930: 49) found the minimum frontal of deformed and undeformed Pecos skulls practically identical.

This measurement is reflected in the frontoparietal index, together with the head breadth; and in the zygo-frontal index, with the bizygomatic diameter. The changes here are what one should expect, given the measurements.

Bizygomatic and Upper Face Height. In view of the striking difference in the bizygomatic diameter, we should expect that the bizygomatic should also register a change as between the Lebanese and American Maronites. However, the Lebanese series averages only 0.69 millimeters larger in this diameter, and the x p.e., 1.84, is the smallest of any in our listing of statistical data. I am secure in stating that the measuring technique in this case should have been quite comparable for both series.

The upper face height, too, differs relatively little. I say this in spite of the 1.4 millimeters difference and the x p.e. of 4.17, because I am aware of the difficulties of accurately deter-

mining the upper point of this diameter, the nasion, under all conditions of measurement in the field. The upper facial index is consoling, with an x p.e. of only 1.86 as between the two series.

The consensus of anthropological literature, examples of which will be cited in Chapter IV, is in favor of the opinion that the face remains unchanged, when deformed and undeformed heads are compared. This opinion seems to be corroborated by the comparison of Lebanese and American Maronite upper faces.

Bigonial and Total Facial Height. In the bigonial diameter we find the greatest difference, except for the head length, between the two series. The American mean is 4.68 millimeters smaller than that of the Lebanese, and the x p.e. is 11.43. The salient point of contrast between Lebanese and American Maronite faces lies in the posterior breadth of the mandible.

When we review the literature concerning the development of the mandible and the general question of the relative influences of muscle and bone, we are in a position to understand how this situation might have arisen.

Cwirko-Godycki (1928: 167) concludes from his comparative study of well-muscled and less well-muscled skulls, that one must especially note the correlation of the gonio-zygomatic index (what is here called the zygo-gonial index) with the index of contractile force of the muscles, which he reckons from the thickness and breadth of the various muscles. His work seems to indicate, in general, that the heavier, more robust skulls have heavier, more robust muscles, and who is there to wonder at this conclusion?

Scott (1938: 933) made experiments on the growth of the mandible in the dog, and concludes: "The greatest amount of growth took place in a region in which the most powerful of the muscles of mastication have their sites of attachment. This supports the hypothesis of Thoma that muscle activity is the most powerful extrinsic influence in development of the length of the jaw."

Thoma himself (1938) quotes with approval Walkhoff's (1903: 129) experiment in which he excised a portion of the temporal muscle in a dog; he concludes his paper with the statement that the development of the mandible is influenced primarily by muscular function and

the associated increase in blood circulation; but the maxilla is not by any means so dependent on the muscles. This is enlightening, for in the case of our Maronites, the upper face remains unchanged when compared with the mandible.

Klatsky (1940: 668) descants on the difference hard and soft food make to the development of the jaw, and says (p. 669) that the bone is dominated by the muscle. He quotes with approval what Keith (1925: 671) writes: "In the inhabitants of our western cities the biting mechanism has fallen into disuse. The overlapping incisor bite has appeared. The cheeks, which are high and prominent when the biting muscles — the masseter and internal pterygoid — are well developed, become reduced and sunken, giving our very narrow, hatchet-shaped faces — our oval cast of countenance." I cannot completely agree with the whole of this statement, on the basis of my findings in this study, since the zygomatic arches do not seem to have "degenerated" as much as they should.

There is considerable difference, however, between the food of the Lebanese and American Maronites. This difference may be found particularly in the greater toughness and roughness of the food in the Lebanon; but at the same time, I do not want to overemphasize this difference. It lies chiefly in the bread.

Waugh (1934: 445) states that the Eskimos' large jaws and regular teeth are due to unusual masticatory activity. Waugh is not without predecessors in this opinion. However, Lewis (1938: 11) remarks on the Arabs, with a diet of milk and dates, and the Africans who feed on porridge, and who yet have fine teeth and facial development; although he admits there must be some sort of association between habits and changes in the skeleton. Hooton (1946: 492), who recognized the fact that the Eskimo skull is not shaped by the chewing of hides, writes: "Stefansson thinks that the Eskimo use their teeth in feats of strength because they happen to have inherited strong jaws, rather than that their jaws become strong through usage. This seems plausible." However, the same author (p. 504) admits that "The use of the teeth in chewing may modify the proportions of the face. Strong-jawed people are likely to have broad faces. . . . It may be that the modern dietary of soft, cooked food has

brought about a partial atrophy of the chewing muscles affixed to the sides of the face and the brain-case, thus diminishing face breadth. By way of compensation, the face may elongate or grow downward along the line of least resistance. This tendency toward lengthening and narrowing of the facial skeleton is certainly pronounced in northwestern Europeans and *in many of their American relatives*, but it is by no means as widespread in modern groups as the broadening and relative shortening of the brain-case." (Italics are mine.)

Friel (1926) holds that we cannot wholly dissociate maldevelopment of the jaws from weak musculature. Lewis (1938: 16) points to the remarkable work of Rogers in correcting malformations of the jaw and dental arches with muscular exercises, and concludes: ". . . while as yet we have relatively little proof of the part played by function in determining the growth and development of the face, clinical observations indicate that in some manner and in some degree function, broadly defined, plays an important role in furthering or impeding the inherent factors that produce the adult facial pattern."

Rohde (1940: 1029) calls attention to the usually unrecognized importance of the muscles of deglutition and thinks these are even more important than the muscles of mastication in developmental stimulation. He also (p. 1033) emphasizes the importance of the muscles of mastication and deglutition as opponents of the whole group of post-cervical muscles. An informative study would be a comparison of the anterior neck muscles and jaw muscles of dolichocephalic as opposed to brachycephalic peoples.

An interesting and modern discussion of the relations of muscles and bones and Wolff's Law is given by Mainland (1945). On page 83, he reformulates Wolff's Law thus: "After the main form and structure of a bone has been developed as a result of its internal (inherent) properties, its finer details and later modifications are due largely to external forces." Or, in a more generalized form: "After its first formation, bone is built and un-built largely in response to demands made on it, these demands including the need for rigidity, for mineral supplies, and for blood cells." And Weinmann and Sicher (1947: 121) well

say: "Forces which are within the limits of tolerance will act to stimulate bone apposition if they are applied to particular regions, and in such directions that they can be regarded as intensified normal forces."

The teeth, too, have their place in this picture. Du Bois (1911) ground down the teeth of animals on one side, and noted asymmetries in the skulls as a consequence of his interference with nature. I have no data on the size of the teeth, percentages of malocclusions, etc., on the American Maronite teeth. But Hughes (1938a: 1066) finds no essential difference in the percentages of occlusal anomalies of Asiatic and American Armenians, a people not too far removed from the subjects of our study. However, he remarks (p. 1069) that not all malocclusions are hereditary — many seem to result from sucking habits, poor nutrition, retarded growth, etc. Hence, a necessary parity cannot be established. Cieszyński (1935: 319), as a matter of fact, claims that the teeth have no influence at all on the bones of the entire jaw, but that they themselves depend for size and shape on muscular function. This seems implausible. But Weinmann and Sicher (1947: 97) assert that the influence of the teeth on the growth of the bone of the mandible is slight (except in the region of the alveolar processes), whereas the influence of bone growth on the development and eruption of the teeth is very great.

However, the influence of change of diet on the whole shape of the mandible and on occlusal malformations must not be underestimated. Price (1939), although primarily interested in teeth, notes the narrowing of the dental arches and of faces as a result, it would appear, of the change from "primitive" and wholesome diets to modern white diet. Making due allowances for racial factors, and for the fact that the change from a Lebanese diet to an American city diet is not so radical as the change from a primitive diet to a partial white diet, Price's findings still have some application here. Particularly illuminating are his remarks on bread (pp. 276-78), since the Lebanese bread supplies all the minerals and other ingredients of whole-wheat, plus exercise for the chewing muscles.

Toverud (1933: 93-94) remarks on the lateral compression of the jaw, which may

often be traced to an early rachitic period in the life of the individual, but which often seems conditioned even earlier (prenatally?). He wonders whether this may not be due to craniotabes. It would be difficult apodictically to rule out deficiencies in the American Maronite diet, especially during gestation and early infancy; all I can say is that, except for this possibility in the narrow lower jaw, no signs of such deficiencies are notable.

The racial factor is a possible complication in this question of the narrowing of the lower jaw. It is true, indeed, that the percentage of Classic Mediterranean in the American series seems to be slightly larger than in the Lebanese series. However, this does not affect the average breadth of the face, as indicated by the bizygomatic diameter, or the height of the upper face. In any case, I wish to reiterate the statement that the American Maronite subjects were children of Lebanese Maronites from the same stock and the same area as those of the original Lebanese series. The small Father-Son series helps to bridge the gap between the two countries. Comparison of the photographs of the two main series used in this study (fig. 4, *c-f*) strongly suggests that the Americans are less rugged-looking, more smoothed-down, than the Lebanese. This situation can be due only to the results of difference of function, so far as I can see.

The literature cited has shown the potency of the influence of function. All that function need do for me, at this moment, is make intelligible an average change of 4.68 millimeters in the breadth of the rear portion of the mandible; a breadth which can include rugosities of bone which obviously seem to be correlated in size with muscular tensions; a breadth of the mandible, which Cleaver (1937: 110) found to be rather more variable in a group, relative

to size, than even the cranium. Finally, this lessened breadth is found in subjects whose head breadth is markedly less than that of their ancestors.

The total face height is 2.82 millimeters larger in the case of the American Maronites than in that of the Lebanese Maronites. The *x p.e.*, 6.17, is large. But, the total face height includes a difference in the upper face height, whereby the American series is 1.4 millimeters larger than the Lebanese series. That leaves a somewhat smaller difference to discuss.

It seems quite probable that the height of the mandible has increased somewhat, in favor of the American series. However, it is impossible to be accurate about this. I did not take observations on the bite for the American series, and even if I had, I could not be accurate even when in possession of this information. The Lebanese series did not have abnormal percentages of types of bite. It showed: 71.2 per cent of over; 25.54 per cent of edge-to-edge; 2.17 per cent of small under; 1.09 per cent of under. A possible reduction in the percentage of edge-to-edge may be possible among the American Maronites. It is also very possible that the wear on their teeth is somewhat less than was shown by the teeth of the Lebanese series, which, however, was not excessive in that respect. The total face height could also be affected by the probably greater percentage of ectomorphs preserved for the American series by more efficient infant hygiene. There would also exist the tendency of this measurement to correlate with the increased stature that I must almost take for granted in the American Maronites. Finally, the total face height is a dangerously complex measurement. I find too many unknowns in the problem to be able to make any more definite statements about the total face height.

IMMEDIATE CONCLUSIONS FROM THE EXPERIMENT

The conclusions to be drawn from this experiment in comparative anthropometry are few and simple.

(1) Cradling, as practised by the Lebanese Maronites causes a great change in the head form; viz., from mesocephaly to hyperbrachycephaly, from normal occipital protrusion to strong occipital or lambda-occipital flattening.

These changes are registered in a greatly increased cephalic index, a greatly decreased head length, some increase in head breadth, and possibly only a small increase in head height.

(2) The changes effected by cradling are primarily noticeable in the posterior portion of the brain case.

(3) It is not clear that these changes are correlated with any changes in the face.

GENERALIZATION OF THE EXPERIMENT

INTENTION OF THIS CHAPTER

THE results obtained from the comparative study of the Lebanese and American Maronite series are of such interest, that it became inevitable that the anthropological data garnered from the various peoples and areas of the world be examined, in an effort to ascertain whether our results might not find corroboration and further illumination from groups other than the Maronites. It would indeed be extraordinary if the Maronites were alone in exhibiting interesting effects of early postnatal infant treatment.

In this chapter, therefore, I shall present the data relevant to the generalization of the results of my experiment, in the form of a comparison of the distribution of hyperbrachycephaly and of cradling or its equivalent. If correlation between these two phenomena be established, strong probability would be created for adhering to the opinion that there is a causal connection between the two wherever found. In addition, this chapter joins Chapter IV, which will be concerned with the literature pertinent to our problem, in offering further knowledge of the conditions and limitations of infant treatment with relation to head form.

GENERAL CONSIDERATIONS

The most economically efficient manner of presenting the numerous data necessary for even a preliminary study of the possible correlation between hyperbrachycephaly and cradling or its equivalent is that of assembling the patterns in map form. Since the Maronites are located in Asia, and since my first perception of any possibility of diffusion of cradling and its correlation with hyperbrachycephaly came from a consideration of that continent, one of my supporting maps (fig. 5) is devoted to the distribution of high cephalic indices there. Europe not only harbors many short-headed peoples, but actually forms one continent with Asia; it is, in addition, of special in-

terest to most modern Americans. The other supporting map (fig. 6) is, therefore, devoted to this area.

All the data for the supporting maps are taken from Gerhardt (1937-38), except those with added initials, derived from the following authors:

- C & B — Chantre and Bourdaret, 1902
- H — Hagen, 1898
- J — Jochelson, 1928
- K — Kubo, 1913
- L — Lopatin, 1937
- M — Martin, 1928
- Mo — Mondière, 1882-83
- P — Porotow, 1895
- S — Schendrikowskj, 1894
- T — Torii, 1913-15

The situation of the aboriginal Americas is simplified, for us, by the many practises of intentional and easily recognizable cranial deformation; it is also immediately under our eyes. These two continents, therefore, need no supporting maps. Africa and Australia are also unrepresented, by default of material for our thesis.

The world map (fig. 7) exhibits, in very general lines, the world distribution of hyperbrachycephaly, according to recorded averages of the cephalic index. It is not possible, in a study based on existing data, to make this an ideal map. One cannot, for instance, always distinguish with certainty between plan- and curvoccipital types of hyperbrachycephalic heads. However, it will become increasingly probable, as this study progresses, that not necessarily all "deformed" heads must be flat in the back. The influence of the early postnatal treatment of the infant does not stop at a certain geometrical form or term, any more than it comes to a halt when a certain index is reached. One of the intrinsic difficulties in the presentation of a world-wide study is the complex variability of effect of the factors we are discussing. This variability is all the more exasperating, because an accurate assessment

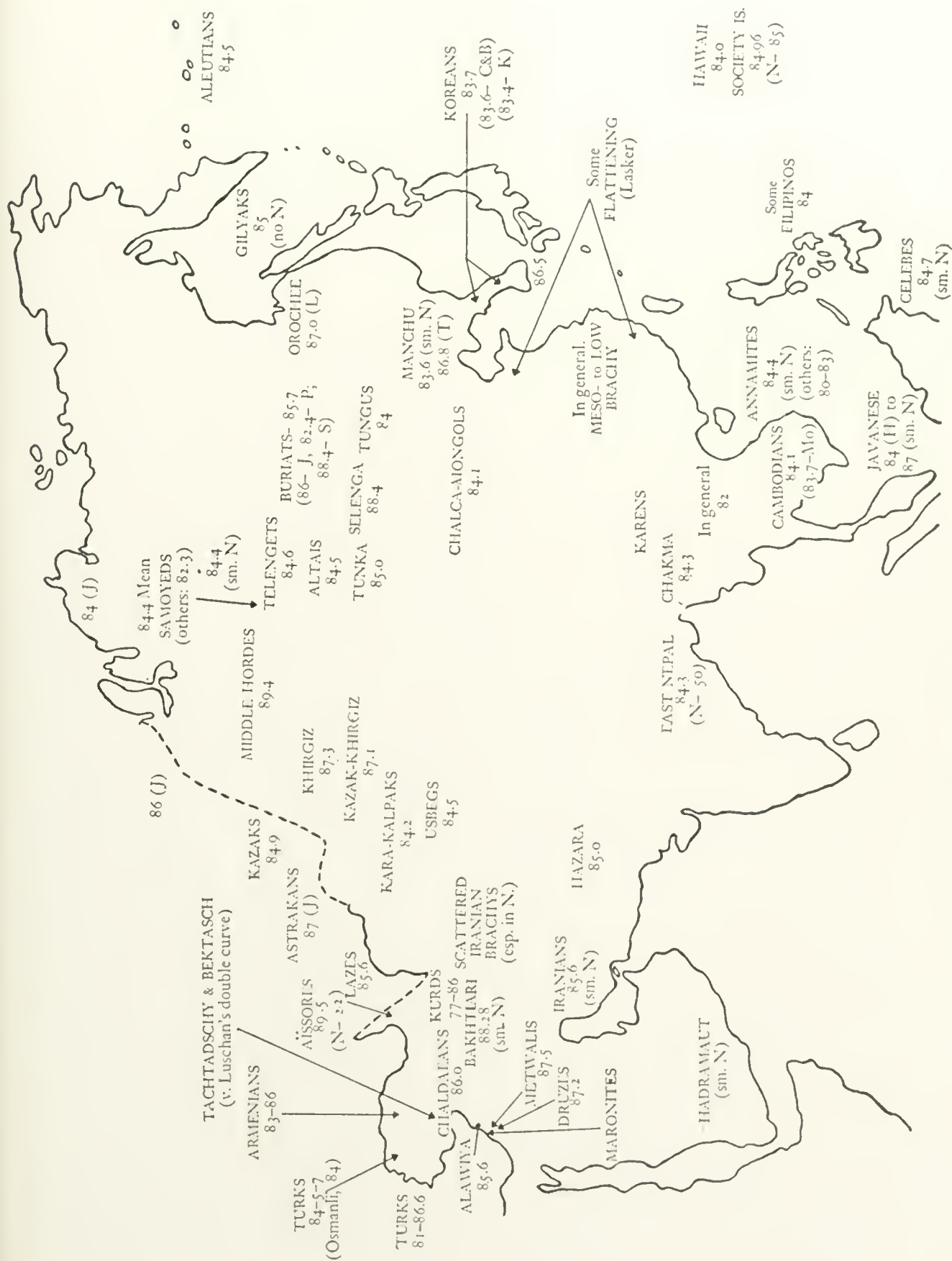
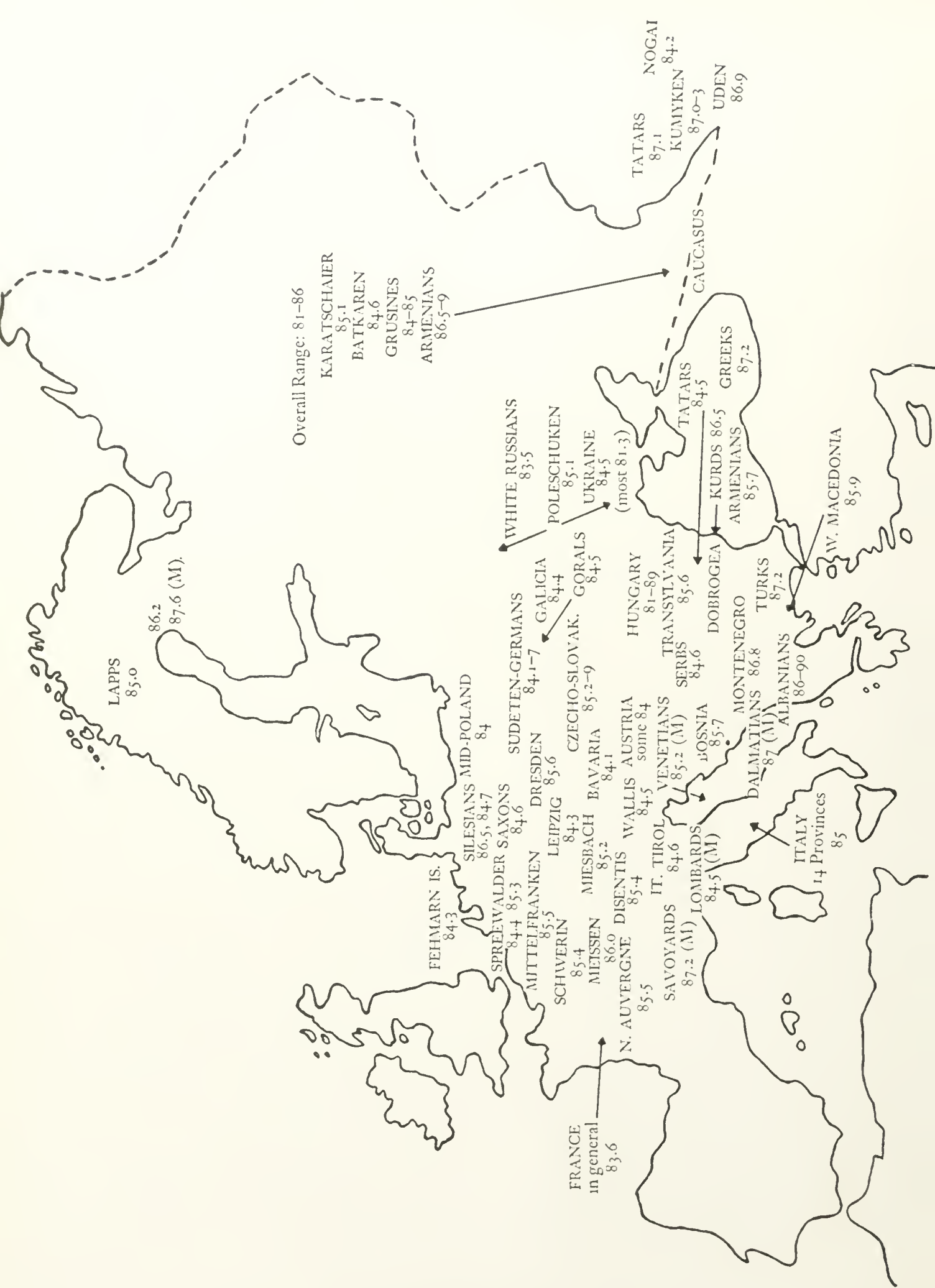


FIG. 5. Map of Asia, showing distribution of hyperbrachycephaly.



of its conditioning is impossible at the moment. Remarks on cradling, for instance, in the literature are almost always of the utmost vagueness. Important variations in custom are mentioned, if at all, very casually.

There is much variety in methods of cradling and in the application of recorded methods. Thus, to establish the fact of "cradling" in an area does not automatically make the people of that region candidates for average hyperbrachycephaly. The actual method itself may be more or less efficient with respect to head-shortening; so, for example, the most widespread form of cradleboard of the American Indians, that designed to be carried vertically, is not conducive to notable brachycephaly. The type employed by some southwestern Indians, which is carried horizontally most of the time, is very conducive. Again, there are areas in which no form of cradling is practised, but an equivalently efficient custom flourishes.

Even among the groups which have an effective form of cradling, the differentials are multitudinous. Such differentials may be: those arising from use or non-use by various social classes; the various materials of which the cradle, and especially the "pillow," may be made; individual variations in adherence to local custom; idiosyncratic characteristics of the infant; intrinsic differences in the constitution of the infants' skull bones; sundry pathological factors. Examples of many of these confusing variables will occur in the discussion of the areas of the world and in Chapter IV. Simply to underline the idea of differentials at this point, I may ask several questions. What idea of the efficacy of Pimo cradling could we have, had not Mason (1889: 184) casually mentioned that the infant in that tribe is cradled until he is capable of supporting himself on his legs, whereupon he is made to stand on the bark cinch of his mother and clasp her neck with his little arms? How can we expect anything else than variability in Navaho occipitals, when Leighton and Kluckhohn (1947: 22-23) tell us that the amount of time the Navaho baby stays in the cradle varies with its temperament and with the situation of its mother, e.g., whether she has older children to help her or not? Are we to expect uniform results from Hopi cradling, after

learning from Dennis (1940: 33) that "The duration of the cradle usage depends in part upon the restlessness of the child and in part upon his motor development"? The catalogue of variation in custom in the cradling areas of the world is lengthy, as witness the rather haphazard record of observation in such a work as that of Ploss (1884, II).

With regard to the registration of the cephalic index, I have tried on the world map (fig. 7) to avoid the Scylla of placing the dividing line between brachycephaly and hyperbrachycephaly too high, and thereby omitting relevant data, and the Charybdis of placing it too low, thereby invading the field of what I must presume to be legitimate brachycephaly. My compromise was 84. Now that the work is done, I am strongly of the opinion that I erred on the side of caution, for much brachycephaly under 84 seems also to be culturally conditioned. However, I leave the cautious error as it stands, for my caution but strengthens the case.

I am forced to deal with the arithmetic mean; but that does not mean that I am unaware of its limitations, both in general, and as conducive to a sharp, truthful focus of the picture of the phenomena I am presenting. The nature of the arithmetic mean is another reason why the world map and the conclusions from this chapter must of necessity be presented along broad lines. Fortunately, certain areas are given some further illumination by the use of groupings of subjects into categories such as dolichocephalic, mesocephalic, brachycephalic, and hyperbrachycephalic. A respectable percentage of both of the last two classes might indicate that cradling methods, which are not universally used in a population and which would not always have identical effect even if they were, are having their effect on a share of the infants.

If, however, we can hope for nothing better than a set of general ideas from this distribution study, yet I think we shall succeed in heaping up such a large number of fairly clear-cut cases of the influence of early postnatal infant treatment on the cephalic index in many areas, that these — taken in conjunction with the results of our experiment — will add immeasurably to the probability of a causal connection. This probability will be increased

by the knowledge that every little patch on the map, outside the main areas of hyperbrachycephaly, seems to be provided with some method of applying external forces to the head which would explain the short-headedness of the region.

In this discussion I am not entering into the question of really ancient deformations. I am restricting myself to recent peoples, about whose customs something authentic can be learned. I shall not, however, delay on areas in which intentional artificial deformation of the head is practised, particularly when the means of such deformation are definite and clear. The literature on the subject is sufficiently expansive to allow me to take it for granted.

Having posited these general remarks, I can turn to the detailed examination of the pertinent parts of the world.

THE DISTRIBUTION MAP BY AREAS

The world map (fig. 7) of the distribution of hyperbrachycephaly has been supplied with numbers. These numbers indicate the specific areas, which I shall now proceed to discuss.

(1) **Australia.** The type of cradle, if it may be so denominated, in use in Australia is what Pflug (1923: 186) calls the "Holztrog," which is a dugout vessel, made of wood, into which the infant is placed. This sort of receptacle is also found in Borneo and the Celebes, and among the Ainu. Dr. Joseph Birdsell tells me (personal communication) that this "Holztrog" is merely a vessel, among the Australians; it is used for many purposes besides holding the baby, and the infant does not spend much time in it and is not forced to assume any particular position in it. A large part of the time the baby is carried astride the mother's hip, as in many other parts of the world. There is no preparation for fastening the infant into the "Holztrog." There is no hyperbrachycephaly among the Australians.

(2) **Borneo and the Celebes.** In these areas, there is considerable intentional cranial deformation (Dingwall, 1931: 124-29; Ploss, 1884, I: 318). The "Holztrog" is also in use here, as remarked already (Pflug, 1923: 187),

but any possible effect of its use is masked by the deforming custom and apparatus.

(3) **Java, etc.** For this area I have no data on cradling, but in lieu of this one may glean scattered information from Dingwall (1931: 122-23) on head deformation, here and there throughout Indonesia, which is enlightening. And all through this area the custom of sleeping on fairly hard surfaces and tough, woven pandanus and bamboo mats should be contributory to brachycephaly on the part of a large number of people. Porter (1889: 231) quotes Forbes on the custom, among the Timor-Laut, of laying the newborn infant on "a hard palm spathe," which is spread in a rough rattan basket; and on the more adult custom of sleeping on bamboo mats, with a piece of squared bamboo for a pillow; Porter also quotes Garson, who remarks on the flattening of the Timor-Laut skulls. This is the sort of thing that goes on throughout the area. The effect of manual massaging of the head on that little patch of hyperbrachycephaly around the Torres Straits (Dingwall, 1931: 132-33) is also very probably meaningful. Serious observers seem convinced that such manipulation, if carried out with intention and perseverance over a considerable length of time, has permanent effect on the head. I suspect that the bedding of the infant on fairly hard surfaces at least assists this manipulation in efficacious change of the infant head form.

(4) **The Philippines.** As a result of my observations, I do not believe that active cranial deformation is currently practised in the Philippines, but the custom was once quite widespread (Meyer, 1881; 1884; Bauer, 1900). The effect of early bedding on fairly hard surfaces is clear to me from my experience in this area. In comparing various groups in the southern Philippines, I found more occipital flattening and higher brachycephaly in groups that laid their infants on mats (usually on the split-bamboo floors) than among those who used cloth hammocks. The idea that early bedding has a causal effect on occipital flattening is shared by Bean (1909: 403-05), who also studied Filipinos; he is particularly of this opinion, because flattening cuts across his classification lines.

(5) **The Ainu.** We have already remarked that the "Holztrog" (Pflug, 1923: 186) ex-

tended to the Ainu. Murdock (1934: 179) merely notes that the baby is put into the cradle, which is suspended from a beam. Putting the baby in a cradle suspended from a beam evidently is not particularly deformative of the head, of necessity; the same description goes for Scandinavia, and there is no special

effect. Porter (1889: 229) quotes a Japanese to the effect that the child is carried on the back of its mother, as soon as it can clasp the body of its parent with its legs. Just how old it would be at this juncture, I am not certain. At all events, the flattening effects of floor-sleeping would not be great, as the child is



FIG. 7. World map of the distribution of hyperbrachycephaly, indicated by hatching (the horizontal lines mark areas in which intentional artificial cranial deformation conducive to the production of hyperbrachycephaly is practised).

evidence of deformation in that region. It is irritating, however, to have so little information about customs like this.

(6) **The Japanese.** These people are brachycephalic (Matsumura, 1925) but I mention them here because of a remark of Dr. Franz Weidenreich at the December, 1946, meeting of the A.A.P.A. He predicated small amounts of occipital flattening of the Japanese, referring to a yet unpublished paper of his. The Japanese, as I have learned from several persons who have lived and observed there, lay their infants on the floor, which is typically of rather pliable matting, placing a cloth or a thin quilt under the babies' bodies. If the infant lies on the floor on its back, which it would normally do for at least four to five months, the floor could have some flattening

not tightly swaddled or otherwise rendered immobile.

(7) **The Cambodians, etc.** Deformation also occurs in Cambodia, but a mixture of parietal flattening (Dingwall, 1931: 97), the custom of placing the infant on a mat on the floor, and the very early and continuous use of turbans by male children, makes the analysis of this part of the world somewhat obscure. The Burmese (Dingwall, 1931: 93) practice deliberate deformation, esteeming a flat forehead as a mark of beauty. In the course of the process, the occipital is flattened as well.

The situation from Burma, across northern India, to Afghanistan, is not as yet well known. There is some intentional deformation here (Dingwall, 1931: 86 ff.). Dr. Gordon Bowles, who is preparing a monumental work on this

part of the world, is not prepared to furnish a detailed report on the cephalic index of the area, nor is he satisfied with the total of information on customs relative to deformation to date. He does say (personal communication) that the Karens are hyperbrachycephalic and have deformation practices.

(8) **Hainan.** Harrower (1928: 251) gives the cranial index of 39 Hylam Chinese skulls from Hainan as 87.89; his photographs show a typical deformed skull of the type we became accustomed to among the Maronites. He reports that the infant is tied to its mother's back in a wicker cradle, in which it may remain the greater part of the day; but the data are not complete enough for my purposes. The presumption of occipital flattening due to cradling is very strong, however.

(9) **China, Manchuria, Korea.** The picture here, as one should expect in such a large area, is complex; but certain correlations of cradling and high cephalic index seem to emerge. Lasker (1945: 314) states that occipital flattening apparently associated with cradling practices occurs in Manchuria and in East China (especially Anhui), but not in South China (except for the Island of Hainan, as we already know). He remarks that most of the Chinese have rounded occiputs (a fact not in itself negating all external mechanical influence on the area), but that various authors (pp. 279-80) mention occipital flattening, especially from the parts of China just mentioned. Dingwall (1931: 99) is clear about deformation among the Manchus, and that agrees perfectly with the hyperbrachycephaly observed (although on a number less than 100). Lasker (1945: 281) specifically mentions that the bulk of the Chinese turn their infants from side to side in their little beds; whereas the people of northern China put a cushion of rice grain under the infant's head and lay it with the back of the head on this comparatively hard pillow. The Koreans are said to have received the custom of pressing the head with flat stones from the people that fled from Honan and Shansi (Dingwall, 1931: 98); the Manchus may have had their ancestral home in the northern part of Korea (p. 99), so I may well presume that the Koreans have some effective form of cradling, even though I cannot at the moment document this statement.

Before going on to groups of people to which the Manchus would naturally lead us, I should like to remark on the state of affairs in several islands in the Pacific.

Hawaii is one of the far-flung exceptions to the fact that hyperbrachycephaly chiefly occurs in a couple of major areas on the map. Here we find that the head of the infant is often placed in the hard shell of a gourd, and adults continue the practice of lying on a hard surface when sleeping. Porter (1889: 232) quotes an old author who thinks that the custom the Hawaiian mothers have of supporting the backs of the heads of their infants with their left hands induces flattening. We may well regard this reasoning with suspicion. As Porter adds, mat pillows and blocks of wood are probably more likely causes of the flattening. Ploss (1884, II: 56) remarks that the Hawaiian mothers do not carry their babies much, but leave them swaddled and lying on a mat most of the day.

On Samoa (Dingwall, 1931: 147-48) stones are employed for flattening the occiput. Tahitians (p. 149; Porter, 1889: 233) have flattened occipital regions, and earnest massage, in addition to hard pillows, is employed there. The process of artificial deformation seems to have been widespread among the Polynesians (p. 232).

(10) **Central Asia.** Returning to Asia, our most interesting area, we come to a group of peoples whose form of cradle (transmuted by cultural adaptation) became that of the Maronites, and whose cradling practices have just as clear an effect, if for the most part a lesser one, on the head form as do those of the sedentary group we used for our experiment. This lesser effect, reflected in cephalic indices for the majority of less than the Maronites' 88, is due partly to variations in the ideal pattern of cradling, partly to the very nomadism of the peoples involved — the infant is carried about more and the cradling is not so serenely done as among the sedentary Maronites.

In this area, we must distinguish forms of cradles typical of it, as opposed to those in favor in near-by regions. The typical north Asiatic cradle type is the "Muldenform" (the tray-shaped cradle) (Pflug, 1923: 189) made of wood, equipped with thongs attached to its sides for use in fastening the infant securely to

its "bed." This type, unless certain variant adaptations are introduced, is admirably fitted for producing planoccipital hyperbrachycephaly. One such variant is the cutting out of the portion of the wood upon which the infant's head would rest, so that only skins are left for the support of the tender head. "Dadurch," says Pflug (p. 190), "vermeidet man die Abflachung des kindlichen Schädels." As a general rule the use of the cradle fades out the farther north we go in Asia; possibly for the same reason that the Eskimo infant is warmer and better protected inside the upper garment of its mother, and the Kamchatka baby in the similar arrangement that is used on that peninsula (Ploss, 1884, II: 83), or possibly because of cultural choice.

The central Asiatic form of the cradle is the "Kastenwiege" (the box cradle) (Pflug, 1923: 192), which becomes, after the adoption of the custom by sedentary peoples, the "Kufenwiege," the rocking cradle (p. 192). The central Asiatic form, often equipped with a mechanism for leading off excrementa, is spread all over the Near East, throughout the Caucasus, and is widely distributed in western central Asia (Ploss, 1884, II: 107 ff.). In this cradle, the infant is firmly bound and left immobile for long periods of time — a process guaranteed to include planoccipital hyperbrachycephaly in the subject. This effect will be the greater the more the cradle is kept horizontal.

The box cradle fits in admirably with the nomadic life of the peoples of central Asia; and details of form, such as the tying in of the baby, make sense when related to nomadic life, rather than to the sedentary, as is obvious.

The documentation for cradling in this central Asiatic region is not a difficult project. The areas, both of hyperbrachycephaly and cradling would be more continuous on the map, except for my restriction of the indication of the cephalic index to that drawn from groups measured in numbers of one hundred or more, and except for a few minor gaps in our knowledge of customs. But the continuous nature of the area as a whole is absolutely undeniable, and presents us with an exemplary area of the diffusion of a custom.

To begin with the far eastern end of the area, we find the Gilyaks a perfect case in point for our discussion. They have the type

of cradling we have been describing (Pflug, 1923: 189), and they have had it for some time, at least (Pérouse, 1799, III: 244-45); they also possess a high cephalic index; and Gerhardt's (1937-38: 411) description of a typical Gilyak skull is exactly one that would apply to the Maronite type of cradled skull.

Gerhardt (1937-38: 412) attributes many of the elements of this description to the heads of the Aleutians, too; but the situation there is not as clear as I should like it to be. These people have a high index (84); but the fact that Hrdlička (1945: 510) denies any more than rare occipital flattening to them puzzled me for a while. The Aleutian skulls that I have been able to examine are quite a varied lot: a few may have suffered deformation from bands tied around the head; some have small lambdoidal flattening; still others are broad and rounded posteriorly. It seems probable to me that the skin (or woven grass) cradles illustrated by Hrdlička (pp. 64, 425-26), often equipped with moss in lieu of a pillow, may produce a shorter but rounded head; it is even clearer to me that infant treatment must be quite variable in this area.

Pflug (1923: 189-92; compare Ploss, 1884, II: *passim*) predicates cradling not only of the Gilyaks, but of the Golden, the Orochee, the Buriats, the Tungus, the Kalmucks, the Mongols, the Kirghiz, and various Turkish-speaking central and south-central Asiatic peoples. Murdock (1934: 155) attributes cradling to the Kazaks, and describes the characteristic method of leading off the excreta by means of a tube. This technique is a criterion especially of the cradling practice of the peoples of the western part of the area we are now considering; we have mentioned it in connection with Maronite cradling. Slight variations, of course, occur throughout Asia. Thus, Seeborn (1882: 62-63) tells us of the softening material (sawdust) placed in the oval bottom of the Ostiak cradle of his day.

Field (1948) offers us new and interesting data on the head forms of Asiatic peoples. The Tajiks (p. 146) have an index of 83.5, and occipital deformation (usually asymmetrical) is reported in 69 per cent of the subjects studied. The Kirghiz (p. 188) are categorized according to occipital form thus: flat, 44.4 per cent; round, 37.9 per cent; prominent, 10.3

per cent; indeterminate, 7.8 per cent. The occipital form of the Kazaks, Tuvans, and Buriats are characterized in general as "flattened-rounded" (p. 192). Nineteen skulls of the Orochees of the maritime area were discovered to possess flattened occiputs. A very interesting point is the information concerning the custom of the Turkomans; at first these people seem to present us with a difficulty, since they yet are dolichocephalic (p. 165), but we are subsequently informed that they practice intentional deformation designed to produce that dolichocephaly (p. 178).

The possibility of a consoling corroboration of our thesis is afforded by the Hazara, whose hyperbrachycephalic index stands out incongruously amid the longer heads of Afghanistan. This little group, however, is really derived from central Asia (Hunter, 1885: 43-44; Jar-ring, 1939: 78-81; Field, 1939: 61, 93, 138, 252), from whence they may well be presumed to have brought with them cradling customs in keeping with the area of their origin.

The scattered brachycephals of Iran present a situation difficult of analysis. There has been some diffusion into the area of the central Asiatic form of cradle, but infant treatment is quite haphazard in this region (Ploss, 1884, II: 34, 57, 109) — a sad fact that more than once blurs the edges of our map and of our knowledge.

(11) The Near East. Pflug (1923: 193) simply makes the general statement that the central Asiatic form of cradle and cradling is spread from the Caucasus to the shores of the Mediterranean without notable change; and this seems to be true. He also points out that there is no evidence that the peoples of the old Iranian, Armenian, or Babylonian cultures ever employed such cradles. That modern Armenians have them is well known (Chantre, 1895; Virchow, 1924; Coon, 1939: 626; for a variant method, see Ploss, 1884, II: 97), as is also the fact that this cradling has at least some influence on the shape of the head. I believe my experiment has demonstrated how much and how important that change can be. Besides our Maronites and the Armenians, other hyperbrachycephalic peoples possess this cradle: some of the Kurds, the Bakhtiari, the Nosarīyeh, the Druzes, and the Metwalis (Dingwall, 1931: 84; and my personal observation of the last three groups mentioned). Chantre (1891: 17) says that the Chaldaeans (or Aïssores)

have the same deformation as the Nosarīyeh and the Kurds, without mentioning the cradle. In view of the facts I have been presenting, I prefer to believe that some of the Kurds, now living in close contact with the cradling Armenians and therefore open to the reception of the custom, have adopted cradling and so become "deformed," rather than that they left the plains of Mesopotamia only six hundred years ago as a long-headed group and became hyperbrachycephalic simply by mixture with the mountain people, who are themselves "deformed" (Coon, 1939: 630).

Such cradling is certainly not an Arab custom, although Pflug (1923: 193) mentions having seen some well-to-do Arab families that have adopted it. In his Syrian study Seltzer (1936: 46) mentions that the center of greatest occipital protrusion may be found in the Damascus district (in the contact-zone between mountain Syrian and desert Arab regions, the "desert-border region"), and that that character becomes less pronounced as one progresses northwestward towards the land of the Alawiya. The Bedawins of the desert, of course, are dolichocephalic gracile Mediterraneans (Coon, 1939: 623). It is, therefore, with frustrated curiosity that I mention a small outlier of hyperbrachycephaly in the Hadramaut region, in southern Arabia. The types discussed by Keith and Krogman in Thomas (1932: 301-33) are obviously "cradled" heads; but I can find no information regarding infant treatment in this region. The same may be said of the few "Dinarics," with flattened occiputs, found in the Yemen (Cipriani, 1938: 134, 149).

The Caucasus is not only included in the distribution-area of the central Asiatic cradle form, but includes also manifestations of intentional artificial deformation (Chantre, 1881-82; Dingwall, 1931: 68-69, 71-72). The Caucasus is a very complicated portion of the anthropological map (as one could guess on first glimpsing a linguistic chart of the area), and cradling is no more uniform throughout the region than is any other characteristic. However, it is common (Pokrowskj, 1900); and one people, the Grusines, are reported to keep the child in the cradle for as long as one and a half to two years after birth.

That the precise custom we are discussing, namely, the central Asiatic mode of cradling, was late in entering the Near Eastern area may

be deduced from a consideration of the various types of skulls unearthed in excavations in the Near East. A useful general review of these, from the point of view of brachycephaly, is given by Sauter (1945), and it would seem that planoccipital hyperbrachycephaly did not manifest itself here until about A.D. 500 (compare Krogman, 1937); that is, as affecting a dominant or large percentage of the populations involved. Perhaps this could be correlated with an invasion of Turkish-speaking peoples, ultimately from central Asia. Perhaps the Maronite bride's "tantūra," so strikingly similar to that worn by central Asiatic women, may add its mite to our evidence of the Asiatic origin of Maronite cradling methods.

Individual hyperbrachycephals appear at least in the third millenium B.C. Perhaps extended and refined information resulting from new researches would cause us to push back the date of the introduction of some method, if not exactly the central Asiatic one, of influencing head form towards hyperbrachycephaly. I strongly suspect that it would be found that some application of external forces which tended to influence the head towards brachycephaly would be discovered to have flourished in the Bronze Age. But here I am speculating, and departing from my proposal to consider only modern peoples in this study.

(12) *The Balkans.* Leaving Asia, we now cross over into Europe. This continent was already equipped with its own forms of cradle, before the introduction of Asiatic forms. Pflug (1923: 201, 203) speaks of the "Trogwiege" (the trough cradle) and the "Korbwiege" (wicker or basket cradle) as European, in opposition to Asiatic forms. He believes, and the fact seems to be, that the "Kufenwiege" (rocking cradle) came into Europe together with an influx of Turkish-speaking peoples. It is certain that such peoples had the Asiatic form of cradle at least by the fifth century A.D., and Pflug (p. 209) selects the Huns as one of the peoples responsible for its introduction into Europe.

The European cradle was never distinguished by methods of fastening the infant into position in it. It was (and still is) very often simply a sort of little hanging bed for the baby; even where the rocking cradle is popular, the baby's relative immobilization in the cradle is

accomplished rather by tucked-in covers than by firm swaddling, and never by thongs or bands, with rare exceptions today (directly traceable to Asiatic influence).

Pflug (1923: 201-05) and Dingwall (1931: 16-78) describe the various cradles of modern Europe, and artificial deformation practised in various sections of the continent.

Crete, as well as Anatolia, shows the effect of the practice of deformation, as well as cradling (Dingwall, 1931: 74). The distribution of both in Greece is spotty. There are local remains of the custom of binding the head of the infant with cloths (p. 73). The average Greek of today is brachycephalic, but not highly so (Morant, 1928: 367), but there are exceptions, in western Macedonia and in the Peloponnesus. It was in Macedonia that Hasluck (1947: 130) came on the custom of present-day head-bandaging (it is of considerable antiquity here and in allied areas [Ploss, 1884, I: 322]), which in this case produced a backward-sloping forehead and a flattened occiput; she also heard of the same sort of custom being practised in the Peloponnesus, by the Vlachs in eastern Macedonia, and by the Turks of Konia. She carefully abstracted the records of any Macedonian heads which seemed to show the slightest deformity. "Even so," she writes, "I have never felt that the records of apparently normal heads which were published by Hasluck and Morant in the paper 'Measurements of Macedonian Men' in *Biometrika*, 1929, pp. 322-36, were fully to be trusted."

In ancient Greece, and indeed in much of the Mediterranean world, the cradles were of two principal types. The *λίκνον* of the Homeric age was a flat swing of basket-work (Porter, 1889: 227-28); there was also a shoe-shaped cradle, in which the child sat up. The infant is wrapped in swaddling clothes (*σπóργανα*) (except in Sparta) concerning which Dingwall (1931: 76) says: "With regard to the swaddling clothes used by the Greeks, it does not seem that these were usually very tight; rather they served for protection against the injuries of childhood." At any rate, the swinging cradle, the shoe-shaped cradle, and other types in which the child sat seemed to have had little effect on the occiput by way of noticeable flattening.

In Bosnia, Albania (Haberlandt, 1917: 182; Nopcsa, 1925: 228), and Bulgaria (Pflug, 1923: 202; Dingwall, 1931: 73) cradling and the

"Dinaric" head form are clearly and causally connected. This subject will be exhaustively investigated for these areas in the forthcoming publications of Professor C. S. Coon and Dr. R. W. Ehrich. Bosnia and Herzegovina are also areas in which a certain amount of head-banding takes place (Dingwall, 1931: 73). One of our many and complicating variables shows its head here, too; at least in 1884, Ploss (1884, II: 36) tells us that the richer people did not bind down the infant into the cradle, whereas the poorer ones did.

(13) **Central Europe.** Actually, our knowledge of cradling customs among individual groups is definitely better for more out-of-the-way folk than it is for many parts of the population of civilized Europe. In addition to the fact of lamentable lacunæ in our preserved information, continuous change makes much of the pattern of European custom fairly fluid.

However, I should like to interject two general remarks at this point. The first: it would be strange if we could drive our correlation of cradling and hyperbrachycephaly right up to central Europe, and then find that purely racial factors took the reins in hand completely. More especially, it would be strange if this happened in a section of Europe particularly affected by the inroads of central Asiatic peoples. The second: it would be strange if, after all the generations of racial analysis practised in Europe, the racial element did not have some effect. I am, therefore, not denying the racial differential here, or elsewhere; any more than I am denying the pathological differential. The most I want to say about Europe specifically (but I shall generalize the statement later) is that this factor of the postnatal treatment of infants according to cultural patterns should be taken into consideration when evaluating the cephalic index.

It is, in fact, only possible to make general remarks about Europe. A great deal of detailed study in various localities would have to be made before anything better could be done. But here and there a ray of light, a definitely focussed ray, does penetrate the gloom of ignorance.

However, general remarks can also be somewhat enlightening. For instance, if one compares the central European section of our hyperbrachycephaly map (fig. 7) with the one on which Dingwall (1931: opp. p. 16) gives

the locations of ancient (i.e., mediæval times on) skulls which show clear evidence of artificial cranial deformation, one notes immediately that they largely coincide, if we add France (a country I shall consider in the next section but one). Now, cradling and intentional cranial deformation are often intimately allied. As Delisle (1902: 124) says: "*De ficeler le corps à ficeler la tête il n'y a qu'un pas.*" And Pflug (1923: 211) is certain that the practice of deformation and the cradle came hand in hand into North, Central, and South America.

The deformations found on skulls in Germany, Austria, Hungary, and near-by regions (Dingwall, 1931: 24-28) show compression of the forehead, as if by means of a board applied to that part. This sort of thing is quite often found elsewhere in connection with the cradling of the child, for example among the Chinook. Some of this may have been practised only among aristocratic families, as Dingwall (pp. 29-30) suggests, and deformation very often has a social differential; the point is that new concepts about the care and treatment of infants' heads had come into Europe. The Huns seem certainly to have indulged in head deformation, to the point of producing a horrific "sugar-loaf" form of head (Dingwall (p. 31); Pflug (1923: 209-10) is convinced that the Huns brought the central Asiatic form of cradle into Europe, as we have already seen.

The European types of cradle we have mentioned—the trough and the basket cradles (Pflug, 1923: 202)—flourished over a wide area in ancient Europe. We find some sort of simple cradle among the Romans, the Greeks, the "Old Nordic," the "Old Germanic" cultures, in France in the ninth and tenth centuries, in Sweden (with the upper classes preferring the hanging cradle, the lower, not), and so on (Pflug, 1923: 201-04). Again I must insist on the fact that the mere word "cradle" does not necessarily and unequivocally mean that one form of cradle is as effective as another in influencing the head form—for that matter, even the same cradle form can be used by different peoples, or different elements among the same people, with varying degrees of efficiency in this regard. Karutz (1899: 237, note especially fig. 22) points out that the Norwegian cradle was often a piece of sheepskin, in which the bedclothes and the infant were

put, and the whole hung out of the way from a beam in the ceiling. A very different apparatus from the central Asiatic form.

The rocking cradle came on the European scene as a new element, and, after adoption, generally became a massive thing. There was a certain amount of wrapping the infant in swaddling clothes even before this form of cradle came in, for instance in ninth- and tenth-century France, but our previous quotation from Dingwall about the looseness of the Greek swaddling would seem to apply here, since more effective work in this line was done later. Even this early, however, artificial cranial deformation was practised.

Such wrapping has been the custom, in many parts of our area, until very recent times. Boas (1911: 48) cites information to the effect that Bohemians swaddle their children from the shoulders down to the ankles; for the first four to six weeks, the arms also were tied tightly to the body. This swaddling continues for the first five or six months, at least, of the infant's life. The head rests on a pillow of feathers or down. This information, added to further information I shall present from the literature of experimental work in Chapter IV, goes far towards suggesting that a large factor, to say the least, in Bohemian round-headedness is infant treatment.

Boas (1911: 49) also adduces information from Dr. M. Fishberg to the effect that the people of eastern Europe, both Slavs and Jews, swathe their infants from the shoulders to the ankles. They lay their infants on their backs in cradles, with their heads resting on pillows. The process continues for at least three months, often as long as six, or even longer, if the infant's vitality be poor. That last element, combined with what we shall learn about the effect of craniotabes from the medical literature in Chapter IV, indicates that here we have the possibility of at least some of the hyperbrachycephals of eastern Europe being strongly influenced by infant treatment. Information elicited from Bohemians, Moravians, and Germans from certain parts of Germany, gives the same picture. Some of the information in the literature is tantalizing. Ried (1930) in his study of the Miesmach population, in southern Germany, casually mentions on page 152, that presents for the newborn baby are inserted in among the "Windeln" — how tightly the baby

is swaddled, for how long, on what kind of a mattress or other support he lies, is he ever turned in bed — numerous important elements remain undocumented.

No doubt it can still be said of the conservative Germans, what Vesalius remarked so long ago: "*Germani ferè breve caput obtinent, quod dorso semper in cunis incumbant.*" "The Germans commonly have short heads, because they always lie on their backs in their cradles" (Dingwall, 1931: 19). Perhaps a writer of today could not state, as does Ploss (1884, II: 38): "Kaum in irgend einem Lande wird das Kind so unzweckmässig eingehüllt, als noch jetzt bei uns in Deutschland." But the lingering influence of such a pattern must still be felt, especially in rural districts; many of the subjects, whose head measurements are registered in the literature, were bedded as infants under the old regime. Ploss (II: p. 38) goes on to describe (e.g., in Bavaria and Frankenwald) the complicated swaddling, done so that the infant will grow up straight (the reason given by the Maronites); in another place (II: 113) he tells how the infant is fastened into the cradle in Württemberg; and in still another (I: 326), how the Swiss midwives strive to give their charges round heads.

Along with the cradling situation, we have in central Europe the complication of intentional deformation: Dingwall (1931: 689) predicates such practices of the Poles, and (p. 65) of the Hungarians.

It is clear that on our map we are using the mean cephalic index of an area of a people, but we are not being completely taken in by this procedure. Even within average dolicho- or mesocephalic groups one finds a greater or lesser percentage of brachys and even hyperbrachys. Even in experiments carried on with numerous infants as subjects (such as we shall see in Chapter IV), the process of affecting the head shape by mechanical means is only successful with a percentage. Whether this be due to inherent racial and individual heredity or not, the converse is true: the presence of a certain number of hyperbrachycephalics could well be due to infant treatment. Or, better put perhaps, to racial *and* cultural and mechanical factors together.

We note from Pflug (1923: 202-04) the presence of the European types of cradles, and also of the rocking cradle ("Kufenwiege"), in

Sweden, England, Holland, Spain, Denmark, and Norway. This type of cradle is by no means so well adapted to the conditioning of the infant to hyperbrachycephaly as the central Asiatic original type. Still, we note from Gerhardt (1937-38: 286) that the low brachycephalic Danes show a percentage of 63 per cent cephalic indices 81-x. The Norwegians (omitting the three northern provinces) have up to 42 per cent 81-x (p. 284). The Finns, who employ a hanging cradle and also a shoe-shaped cradle which is carried on the mother's back and in which the infant is fastened and spends most of its time for the first year (Buschan, 1926: 950, 955), have 76.5 per cent 80-x indices, and 67.8 per cent 81-x (Gerhardt, 1937-38: 287). I do not have to insist on this point, since 80 or 81 and over in the proportion of 70 per cent of the population proves that there are a great many high brachycephals and hyperbrachycephals present in the population in question.

(14) **Russia, Lappland.** Russia is characterized by a general brachycephaly (Tschepourkowsky, 1922, by Provinces; Gerhardt, 1937-38), which increases in index towards the south, and is 83 from the Carpathians southward and toward central Europe (Tschepourkowsky, 1911; Gerhardt, 1937-38). A great deal of intentional deformation has been practised here (Dingwall, 1931: 33 ff.), and pads and compresses have been employed at least until very recent times (pp. 68-69), if not up to the present. The various forms of cradle mentioned are also in use in this territory. Ploss (1884, II: 36) tells us that in his time the Russians in Astrakan were strict about swaddling the infant and keeping it motionless in the cradle; in the district of Samara, however, the baby was now overwhelmed with clothes, now left naked on the floor.

A very interesting and clear-cut case in point for our study is afforded by the Lapps. They practise molding and bandaging of the head, they employ head-dresses that constrict the head, and they have the cradle, of an effective type (Hatt, 1915). The description of the typical Lapp skull that Gerhardt (1937-38: 407) derives from various authors sounds very familiar, especially in the last phrase: "In der Norma lateralis steigt die Stirn bei der genannten schwachen Glabellarentwicklung steil oder

ganz wenig geneigt bis etwa zum Metopion auf, verläuft dann mit schwacher Steigung in deutlich flachem, aber kurvigem Zuge nach hinten über das Bregma bis zum Vertex hinauf, um von hier mehr oder minder steil zum Lambda abzufallen, in dessen Bereich die Mediansagittalkurve sehr oft eine — häufig recht starke — Abflachung aufweist." (Italics are mine.)

Karutz (1899) gives an illustration of the Lapp cradle, and Hatt (1915: fig. 40) a photograph of a Lapp women exhibiting the "hinged" flattening — and the connection between the two is plain. Turi (1931: 36-37) gives a firsthand account of the intensive cradling of the Lapp child; an account which might do, in its essentials, for that of any nomadic cradling people, from central Asia to Patagonia. Hatt (1915: 255) has a wistful sentence, that I may well echo, thirty-two years later: "As the practices connected with the bringing up of infants are rather apt to escape observation, this side of the life of primitive tribes is by no means as thoroughly known as it ought to be."

(15) **France, Italy.** Before finishing with Europe, and retracing our steps so as to follow the other arm of the diffusion of the Asiatic cradle and its sequelæ which extends to the Americas, we must discuss the situation in France and Italy.

France is the "classical" country for artificial cranial deformation in modern times (Dingwall, 1931: 19), and numerous examples of such practices in fairly ancient times are known (pp. 46-62). The highest modern cephalic indices are still recognized in the region of the central plateau of France, which I am assured is an intensely conservative area, in fact practically marginal in some respects. Lapouge (1897) reports various high indices, from 90 to 100, from this area, blandly ignoring the possibility of deformation. On the southern extension of this plateau, Delisle (1902: 144-46) describes the swaddling of babies and the binding down of the infants' heads themselves in the cradle. Collignon (1887: 309) is puzzled by the presence of high brachycephals in the mountainous areas of northeastern France, in spite of the fact that the stature of these short-heads is great. In the normal course of events, the greater the stature, the greater the head length. Gueniot (cited in Dingwall, 1931: 55-

56) tells us of a particularly decisive local method of swaddling the infant and tying down the head with a triangular piece of linen. There are, then, in France, effective methods both of lengthening and shortening the head, the first being mostly the use of circular bandages from forehead to sub-occiput, and the latter connected with cradling. No picture of the status of the cephalic index in France could do well to ignore these culturally patterned interferences with nature. And it is high time that France were studied all over again. Apart from such improvements in our knowledge as the application of the newer techniques would make possible, one might anticipate a change in the cephalic index map. I should not be surprised if changing custom had not brought about a fall in the index particularly in certain areas, a fall which would be more marked and conclusive than that recently noted in Switzerland (Schlaginhaufen, 1946; Sauter, 1946: 147).

The cephalic index map of France (Gerhardt, 1937-38: 397) shows many interesting variations in this criterion. I do not know exactly what customs are practised along the semicircle of high indices that covers France's northeastern borders. I do know that many a person, who belongs to Broca's old (1873) "*type celtique*," does so at least in central France, and probably elsewhere, because his mother induced the "Celtic" hyperbrachycephaly after he was born.

Notice of the Savoyards on the map leads us to a consideration of the peoples on Italian territory. The Savoyards themselves, big-headed and short-headed, are connected with a hyperbrachycephalic central European area, and so are the northern Italians. The Tirolese, whether German or Italian, are notoriously short-headed. And so are many Swiss. I shall reserve some interesting remarks about the Swiss (which may be applied also to the Tirolese) until I cite the literature on the problem of brachycephalization, especially of central Europe, in Chapter IV.

As regards Italy, Gerhardt (1937-38: 319-20) reports not less than 27 provinces that show 90 per cent of 80-x indices. Other figures are as impressive. In a general way, this brachycephaly is strongest in the north of Italy, and shades off into longer-headedness as the "ankle" and "heel" of the "boot" are reached. The

province of Naples, however, possesses a percentage of 80-x indices as high as 80.9. Boas (1911: 49) states that Neapolitans and Sicilians swathe their infants, and that swaddling continues until the infant is weaned. During the summer, however, children are freer than during the winter. That is the sort of qualification that is forever entering the reports, leaving a distressful uncertainty behind it.

A few specimens of ancient skulls showing deformations have been discovered in Italy (Dingwall, 1931: 28-29) but they are not so numerous as elsewhere in Europe. Dingwall (p. 62) also reports some molding as being practised in this country. Just how much, or how intensively, or how long it is practised, I do not know.

(16) **The Americas.** The main areas which are or were characterized by intensive and intentional artificial cranial deformation in the Americas have been indicated by horizontal hatching on the world map (following Imbelloni, 1934-35: *tafel* 18). In general, the incidence of this practice coincided with the western mountain backbone of the two continents, overflowing occasionally. This overflowing was notable in the southeast of the United States, where, however, the cradleboard became pre-eminent among deforming methods, and only occasional examples of other mechanical devices are found (Dingwall, 1931: 183-89). Intentional deformation also followed around the curve of the West Indian Islands.

The "Mound Builders" and other pre-Columbian Indians left skulls which show evidence of deformation (e.g., Hooton, 1920; Webb and Snow, 1945). In studying the Madisonville skulls (Hooton, 1920) and later in his much larger work on the Pecos skulls (Hooton, 1930), Hooton shows how much the cranial index may be changed by simple occipital flattening. In fact, his was the first important craniological study of which I am aware that recognized the problem and attempted to determine the normal status of the population in question by juxtaposing deformed and undeformed skulls.

The use of some sort of cradle, however, is more widespread by far than is the practice of intentional artificial cranial deformation. The chief varieties of cradles, beginning with the North, are (Pflug, 1923: 194-200): the

"Rindenwiege" (bark cradle) among the Indians of inner Alaska and along the Mackenzie River; the "Trogwiege" (trough-shaped or dugout cradle) in the case of the Northwest Coast Indians; the "Korbwiege" (basketry or wicker cradle), confined to the western part of North America; the "Brettwiege" (cradleboard), the simplest and most widespread form from the Northwest Coast throughout the central continent and down to Mexico; the "Hurdewiege" (the slat or fence-like cradle) of such people as the Ute, the Yuma, and the Cliff-Dwellers; the "Lattenwiege" (ladder cradle) of many Plains tribes, such as the Comanche, the Kiowa, and the Sioux. All of these types, and innumerable intermediate forms, occasionally concomitant with intentional deformation, are found in North America. They are all varieties of the fundamental "cradleboard" — a device for securing the infant to a flat surface, thus rendering it relatively immobile and a handy unit package. It is interesting, as Ploss (1884, II: 81) remarks, that only among aboriginal Americans is the infant carried with its back to that of its mother.

The general picture in South America is similar to that found in its northern counterpart — a distribution down the mountains of the west, spilling over at times into the bulk of the continent; in this case the overflow takes place in the north and in Patagonia. The famous Aymara deformation on the Andean heights is familiar; almost as well known is the occipital flattening of many Patagonians, who employ woven cradles (Pflug, 1923: 196) and forms of the "Brettwiege" (cradleboard) (Virchow, 1879: 200).

Africa is, in fact, the only continent without cradles. Pleasantly enough for our thesis, it is also a continent of unrelieved dolichocephaly (some of it encouraged by intentional deformation), except for a low brachy area inside the western bend of the continent, and a tiny hyperbrachycephalic area around Lake Chad; in all three exceptions deformation is proven or suspected (Dingwall, 1931: 102 ff.). The little, somewhat dubious spot indicated on Madagascar (see map, fig. 5), is easily explained by the local custom of fronto-occipital deformation (pp. 119-20).

Coming back to the Americas, I shall now go somewhat more into detail concerning the cradling customs that flourish there.

Some Eskimos are no doubt affected in head form by hard pillows or head rests (Mason, 1889: 166), but on the whole the infant Eskimo is plumped into the back of the mother's upper garment, and so escapes much-continued pressure on certain areas of the head. Hrdlička (1924: 50) gives the cranial index of some 61 "Alaskans and Athapascans" as 82.1 for males; 48 females have an average cephalic index of 83.4, so I may well assume that the "Rindenwiege" (bark cradle) mentioned by Pflug has some effect. Among the "Tinne or Chippewyan," Mason (1889: 166) reports the custom of fashioning the "cradle" so that the infant sits on a soft fur seat. Sitting cradles are not usually effective in producing shortening of the head.

The Chinooks and the Nootka (and other neighboring peoples) employed a "dugout" cradle (Pflug, 1923: 194), and an apparatus for deformation the results of which no one could mistake (Dingwall, 1931: 164 ff.). One might develop the speculation on the possibility of flattening being first an accidental effect of cradling, then coming to be regarded for some reason as desirable, and finally being fostered and improved on. We are not deploying into the field of ethnology in this study any more than we have to for our essential purposes. However, I must again call attention to the fact that social differences are important to our study. The average cephalic index of a tribe will be quite different if only the aristocrats, the descendants of the conquering group, employ the cradle — or if everyone uses it. The gradual disintegration of the pattern or patterns connected with cradling would also apply to our study. In fact, one very great difficulty (unsolved at the moment, because of the disproportionate amount of labor involved) in my consideration of America is the fact that I am not always able to pin down a definite custom to a definite cephalic index at a definite time. Is my record of cradling for a tribe synchronous with the record of the cephalic index, as recorded in the original study or in such compendia as Steggerda (1932) or von Bonin and Morant (1938)?

The Modoc (Dingwall, 1931: 182) show an interesting mixture of methods: bandages around the head being favored by some, fronto-occipital methods of deformation by others; some use the sitting-type cradle, others the

board type, which latter seems to have been designed to stand against a wall, or somehow set up vertically (Mason, 1889: 179).

The "Korbwiege" (wicker cradle) is found only in the western part of North America (Pflug, 1923: 195); such people as the Salish and the Thompson Indians have it; the Hupa and the Shasta have the slipper-shaped or chair cradle. The simplest and most widespread form of cradle spreads out towards the east: the "Brettwiege" (cradleboard) (p. 197). The Chippewa, for example, the Blackfeet, the Sioux, the Crow, the Algonquins, the Iroquois, the Ute, and many other tribes use either a simple or derived form of the cradleboard.

One great difference in effectiveness for cranial deformation between this form of cradle and the "Kastenwiege" (box cradle) of central Asia or the "Kufenwiege" (rocking cradle) of the sedentary folk is the fact that the box cradle is intended to be and normally is held horizontally. The weight of the relatively immobilized head against the "pillow," therefore, is a powerful factor in producing occipital flattening and hyperbrachycephaly. The cradleboard, on the other hand, is intended to be and quite usually is carried upright, either on the mother's back, on some other form of transport, or stood upright against a tree, hung upright from a bough, or otherwise disposed, but upright for all of that. The effect on the shape of the head, no matter how firmly the infant is fastened to the board, is quite other than among the users of the central Asiatic form or its derivatives.

So, for instance, among the Iroquois, the mother carries the cradle by a tumpline, and often hangs it on the branch of a tree (Murdock, 1934: 311), and in addition all Algonquin and Iroquois cradles have a footboard, to support the infant from below and take the weight off the fastenings (Mason, 1889: 204). The Aztec mothers carried their infants in wicker cradles on their backs (Murdock, 1934: 383). The Chippewa, Blackfeet, Sioux (for these there is a footrest, and the arms of the infant are usually free, except on journeys), the Ute, all carry the child vertically (Mason, 1889: 168, 188, 201), and in general Mason (p. 193) remarks that there was plenty of free play to the infant's head. Now, I am in no position to state just how much effect this method has on the infant's head. Are all the Indians with in-

dices of 79, or even somewhat higher, listed by Steggerda (1932), absolutely untouched by this process; or would their indices have been even lower, without such cradling? I am inclined to think that these heads are fairly normal in cephalic index. Again, different tribes have changed their customs in this respect. Catlin (1841, II: 112) already noticed diminution in deformation customs among the Indians he visited in the dawn of the last quarter of the last century. And certainly the successive generations of Indians in the southeastern part of the United States were no more uniform temporally than spatially in deformation.

A difference in use of quite similar cradles was acutely noticed by Hrdlička (1908). He was clearly conscious of the fact that immobilization of the infant on a pillow could produce occipital flattening (Hrdlička, 1947: 49); and the difference ties in with great differences in the cephalic index. Hrdlička (1908: 79) remarks that tribes such as the Ute, Jicarilla, Pima, Papago, Walapai, Havasupai, and most Mexican tribes he investigated, use the cradle, but in such a way as to leave the head normal in shape. On the other hand, the Apache, Navaho, all the Pueblos, and the Yuma limit the motion of the infant's head and thus induce occipital flattening.

However, Hrdlička unfortunately did not distinguish between "straight" occipital flattening and "hinged" flattening, and he did not note the fact that "hinged" flattening can very easily pass over into lambdoido-occipital flattening, which in turn can easily merge with lambdoidal flattening. All of these flattenings are caused by external pressure during infancy. I speak here of lambdoidal flattening when it is recognizable precisely as caused by deformation; I do not wish at this point to say that all simple lambdoidal flattening is caused by mechanical external forces. At any rate, I am not sure that all of Hrdlička's "normal" heads really were such.

A large amount of the lambdoidal flattening I have seen on Indian skulls is, I am convinced, caused by external forces, and this is perfectly clear in cases of what Hooton (1930: 37) calls "lambdoid deformation," which is, as described, smaller in area than what Stewart (1940: 154) calls "lambdoid deformity." One of the reasons I feel there is a large chance for imperfect correction in Shapiro's (1928)

formula for the correction of deformed heads is the very fact that the plane of the flattening can "swing" on its "hinge," as well as change in area, and will affect the metrical picture variously as it changes.

At any rate, the slanting, fairly high, often small flattening, which we can call "lambdoidal" or "lambdoido-occipital" (according to the noninvasion or invasion of the occipital region) may have two kinds of possible explanation in external forces operating during early infancy. The first is the build of the cradle. Imbelloni (1934-35: 175) makes an illuminating remark in this respect. He refers to the practice among many tribes, such as the Ute, the Apache, the Ojibway, of placing the baby in a cradle which is turned up in one way or another at the head end. Mason (1889: 178) gives an illustration of a Hupa curved-back cradle which turns up at the head end. When the baby lies (or half stands) in such a cradle, his head is not lying back naturally, but the vertical axis of the head forms an angle with that of the body, and the baby's chin approximates (sometimes closely) the anterior uppermost chest region. In this case, says Imbelloni, "Der Schädelteil, der abgeplattet wird, ist rein lambdisch." I have noted lambdoidal flattening on Californian Indian skulls which could very well have been so caused.

The second method of producing high, "hinged" flattening—a method conducive to flattening over a wide area of the posterior part of the skull—is that of placing a neck pad or a pillow under the shoulders and neck of the infant. This is done, for instance, by the Hopi (Dennis, 1940: 31), and it is interesting that they allege the same reason for the practice as the Maronites, namely to prevent the child from growing up short-necked. The Hopi also carry the cradle horizontally. The combination of these two factors is guaranteed to produce a large "hinged" flattening. Some time ago I referred to a comparison between the profile of the posterior skull among the Alkali Ridge Indians and the first of my Lebanese Maronite photographs (see fig. 4). The combination of a neck-and-shoulder pad and the cradle among these Indians could well have produced that slanting lambdoido-occipital deformation; the Maronite infant is often, as I have indicated in Chapter I, so placed that the pillow is under his neck and shoulders, and the

head rests on the mattress or top of the pillow at an angle.

In connection with lambdoidal flattening, it might be interesting to insert here the opinion of Abels (1925) that, if there are any weak spots in a skull with such tendencies, they are as a rule in the portion of the skull where the sagittal suture begins to curve towards lambda. Localized and relatively unimportant pathology could, therefore, add to the picture of lambdoidal flattening.

I have no such exact information about the construction of the cradles of other Indians who used the cradleboard, which would bear on this aspect of cranial deformation, namely, the formation of a "hinged" flattening of some kind. But the possibility must be kept in mind when comparing the cephalic indices of Indians who vary around 79-80 (Martin, 1928: 777; Steggerda, 1932; von Bonin and Morant, 1938) and their customs of cradling. The possibility actually exists of lambdoidal flattening changing the breadth slightly without particularly affecting the length, and also of its increasing the length. One gets the impression from some skulls (e.g., from the Alkali Ridge Indian skulls) that during the course of subsequent head-length growth (described in Chapter IV) the occipital bone pushes itself out in an almost autonomous way, and that the head is even longer than it would have been if not disturbed by artificially induced lambdoidal or lambdoido-occipital flattening. The study of occipital flattening is not complete until a thorough study of lambdoidal flattening appears.

I must remark on an illuminating bit of information from the archaeological consideration of "hinged" flattening in the Southwest. While this paper was first being prepared, Brew (1946) published his monograph on Alkali Ridge and (pp. 67-73) discussed the "Pueblo Invasion," basing his remarks chiefly on the study by Seltzer (1944). Seltzer's conclusions, first published in an abstract, were corroborated by Stewart (1940) even before the publication of the 1944 paper. Briefly, the conclusion is that the invasion of brachycephals into the Southwest in ancient times was not the invasion of a new type of people, but of a new custom. Other features than those which would be affected by flattening are practically the same all through early Indian

history in the area, and even down to the present day (Seltzer, 1944). Incidentally, Seltzer's (p. 11) comparison of Old Zuni and Utah Basket-Makers interested me personally, because he obtained the same contrast (although with smaller numerical results) that I found comparing the Lebanese and American Maronites, i.e., large x p.e. for the head length and associated indices.

To get on with our survey of the Americas. Mexico, Central America, and the Islands of the West Indies are notable for intentional cranial deformation (Dingwall, 1931: 151 ff.), but, naturally, not all of the populations involved were equally affected all the time. Hrdlička (1935: 313) gives 79.1 as the mean cephalic index for 46 Aztecs, and it has already been remarked that Aztec mothers carry their infants on their backs.

Other references to deformative and cradling practices for Central America are given by Porter (1889: 221 ff.). I do not think that any more than this cursory attention to this region would be particularly profitable.

The peoples of the various Andean civilizations (Steward, 1946-48) need no new advertisement of their intensive and extensive deformative practices (Dingwall, 1931: 193 ff.). These practices all were accompanied by the use of the cradle (Pflug, 1923: 198). Indeed, one of the difficulties of this study, or, conversely, of a study like Dingwall's, is to keep one form of deformation separated from the other.

The possible relationships of cradling practices and ecology are intriguing. So, for example, Mason (1889: 209) remarks on a general dichotomy in South America: in the tropics the children are carried in a shawl or sash, and bedded in a hammock; in colder regions, the cradle frame appears. In South America, it is true, cradling and deformation follow the mountains, as a rule.

The Incas swaddled their infants tightly and placed them in cradles, from which they were only removed for their morning cold bath. While in the cradle, deforming apparatuses were applied to them (Murdock, 1934: 434-35; Dingwall, 1931: 203 ff.). Running down the mountain chain from north to south, with the exception of a small area in which circular bandages were applied, straight up-and-down boards or pads were used; in the northeast,

continuing the line of the West Indies, pads applied at an angle were employed (Imbelloni, 1934-35: *tafel* 18). How the details of the construction and use of a "cradle" can be of extreme importance in determining its effect is illustrated by a passing remark of Mason (1889: 209) concerning the cradle frame of the Araucanian Indians, which, he says, left the head of the infant perfectly free, except that the lower part of the occiput rested on the topmost crosspiece, "as in the case of the Polynesian pillow." Does this tend to lengthen the head? Or leave it unaffected, since the nuchal musculature of an infant is undeveloped and the occipital protrusion great, relative to its adult status? How long is the infant kept in this situation?

Patagonia is one of the most interesting areas yet mentioned. The cephalic indices are mostly very high (Kate, 1906: 47; Virchow, 1879: 200; Martin, 1896: 533); Virchow comments on the occipital flattening observable, and Martin (1896: 504-05) clearly recognized the skulls as deformed, as did Verneau (1903: 122 ff.) and Dingwall (1931: 222-24). The Tierra de Fuegians, on the other hand (Martin, 1893), are definitely mesocephalic.

The Patagonians use a cradleboard but add a piece of wood on either side of the head of the infant and tie a shawl over this arrangement, in order to protect the child's head while it is being transported on horseback. While this apparatus no doubt represents an adaptation due to the comparatively recent introduction of the horse, the people must have had dorsal decubitus before (Dingwall, 1931: 222). On the occasion of the visit of a Patagonian family to Germany in 1879, Virchow remarks on the possible easy transition between cradling, accompanied by methods of keeping the infant's head from lolling dangerously while being transported, and the gradual introduction of intentional deformation (Virchow, 1879). Cooper (1946a: 120) reports a ladder-type cradle for the Ona, and (1946b: 154) illustrates a wicker cradle with a curved foundation to fit the horse's back, among the Patagonian and Pampean Hunters; while, in contrast, Métraux (1946: 319) says of the neighboring, much more long-headed Chaco folk merely that "Women carry their babies in a sling, straddling the left hip."

With this cursory, and not too satisfactory

survey of the Americas, I bring the study of the correlation of hyperbrachycephaly and cradling (or the equivalent) to a close.

It may be of minor, and ironical, interest to note here that the cradling we have been speaking about, although rather drastic in appearance to American eyes, seems to have no harmful effects on the infant involved (Danziger and Frankl, 1934; Dennis, 1940: 104, 107; Greenacre, 1944; Orlansky, 1949: 21-24). The custom makes a manageable packet of the helpless baby and often induces a change in its head form — a change which is of interest only to a few anthropologists. The head form, however, is of sufficient importance to them that this evidently widespread and efficient cause of its deformation should be taken seriously.

CONCLUSIONS FROM THIS CHAPTER

The ideas garnered from the considerations presented in this chapter may be simply stated.

The direct conclusion from the study of the distributions of hyperbrachycephaly and cradling (or equivalent) is that there is a universal connection between the two. This conclusion, however, because of lacunæ in our knowledge of customs in various small portions of the world, must be characterized as extremely probable — “probable,” because we cannot definitively prove it for each and every case; “extremely probable,” because of the vast and general sweep of the correlation. Certainly, when we consider this sweep with an anthropological eye, we realize that we have an interesting picture of diffusion; and, equally certainly, when we regard it with the eye of logic, we are well within our inductive premises when we conclude that the factor of infant treatment must be taken into account, and must be accurately assessed, before apodictic statements may be made about the cephalic index or associated phenomena.

THE LITERATURE PERTINENT TO THE EXPERIMENT AND ITS GENERALIZATION

THE purpose of this chapter is to garner from a review of the relevant literature whatever information may be found capable of affecting such clarity or certitude concerning our experiment and its generalization as may have been acquired in the preceding two chapters.

I thought it advisable to present the rather clear-cut results of the comparative anthropometry of the Lebanese and American Maronite series first, then to discuss the generalization achievable by distribution studies, and finally to consider whatever pertinent literature that might be unearthed. The literature, then, is examined in the light of what has gone before;

and the irrelevant spared. But this does not mean that I have suppressed any recorded data inimical to my thesis.

Actually, it will be found that in this chapter that the fortunes of the thesis of this study may be characterized by the Vergilian tag, *Virēs acquirit cundo*. It seems to me that the cumulative effect of the corroborations and suggestions to be displayed here is of great value; the chapter should be read in its pedestrian entirety, or not at all.

The literature is to be reviewed under the following headings: *The Anthropological*; *The Embryological and Obstetrical*; *The Pediatric and Growth*; *The Medical*.

THE ANTHROPOLOGICAL LITERATURE

Literature on Artificial Cranial Deformation

There has been much written, in anthropological publications, on the various types of mutilations and deformations with which the sundry groups of human beings afflict one or other part of the body (Puccioni, 1904), and particularly the head. Fortunately, Dingwall (1931) has saved us a great deal of trouble by compiling the available sources on the subject of artificial cranial deformation, and I have made liberal use of his book in Chapter III.

For our purposes, two conclusions that can be drawn from this literature are of some importance. The first is the conclusion that the fact that effects of deformation endure is clear. This fact has been well known for a long time. Drastic methods, such as those of the Chinook, produce drastic effects, which persist through later life; less drastic methods, such as cradling, also produce permanent effects; just how little the normal head grows out of early shortening (and how much shortening) will appear from the literature on growth.

The second conclusion is practically no conclusion at all. It concerns the amount of time necessary for the deforming force to

work before it produces lasting effects. Something like nine months seems to be the minimum that peoples actually cradle their infants in the central Asiatic way; but is so much time necessary? The more spectacular forms of intentional deformation have been said to be complete after three, five, or eight weeks, as Catlin (1841, II: 111) described it for the Chinooks. Longer times (three months; six months to a year; until the child can walk — Macfie, 1865: 441) have been elsewhere simply recorded as the local custom (Rosa, 1947). In the case of occipital flattening alone, for which relative immobility of the head and gravity and a substance against which the head can press must take the place of the more drastic intentional apparatus, would not a longer time be required than the minimum with apparatus? A digressive question at this point would be that concerning the efficacy of molding the head with the hands — does this not need subsequent recumbency upon a hardish substance for implementation in producing head-shortening or planoccipitaly? There is more than enough room here for accurate observation (not always to be found recorded in ethnographic studies), if not active experimentation. A few simple studies on disparate peoples would settle this simple problem.

The Cephalic Index

I do not feel it would be useful to spend any large space on a consideration of the history or present status of the cephalic index and the divisions thereof. Stewart (1936) has adequately surveyed the history; Hooton (1946: 488 ff.) discusses the index at length, concluding with a much lower opinion of it as an absolute criterion than that worthy percentage has often enjoyed during the long years since its first proposal by Retzius. This study does nothing towards inflating the ego of the cephalic index, particularly as a major diagnostic — the rôle it has been too often called upon to play unaided in the study of races and racial movements.

In view of the several uses we shall make of the paper of Abbie (1947) in our review of literature, it is only right that we should mention his stimulating proposal for a redefinition of mesocephaly. Basing his claim on the mesocephaly of the neonatal head, Abbie (p. 253) claims that a range of cephalic index from 79 to 82 represents the "natural" one for modern man; dolichocephaly under this, and brachycephaly over this, would be aberrations. I should not hesitate, myself, to call every head with a cephalic index over 82 "hyperbrachycephalic" (in the sense of being shortened beyond what is natural, and that almost always by external forces), as a result of the investigations this study presents.

Craniological Studies

Under this heading, we present a sampling of the findings and opinions of craniologists, which have relevance to our main thesis.

Von Lenhossék (1878: 10) experimented with weights on the heads of infant cadavers and discovered that direct pressure from behind on the occipital protrusion presses this bone flat, but affects the other bones of the vault but little.

In a very good paper, Merkel (1882) proposes his opinion that the body of the occipital has no influence, even indirectly, on the anterior half of the skull; he especially excludes the face. Merkel is firm in his belief that the portion of the skull anterior to a line or plane drawn from bregma to porion is much more stable in form than the portion of the skull posterior to that line or plane. Many of the

other authors to be cited also focus their attention on the posterior portion of the skull, for one reason or another.

Toldt (1910), although not the first to create the distinction (he was preceded by His with Rüttimeyer, 1864) had the greatest influence in the general acceptance of the dichotomy between planoccipital and curvoccipital brachycephaly. According to Toldt, the chief difference between short and long skulls lay in the build of the posterior portion of the vault. The dolichoid skulls were well arched posteriorly; the brachyoid skulls were always short, steep, and more or less flat in the rear. The skulls in his collection which were fairly long, but still possessed a little flattening in the occipital region he labeled, charmingly enough, "Unbekannt."

Toldt (1910: 223), after considering the various bones of the skull vault, came to the following, and somewhat discouraging conclusion: "Es darf vielmehr als erwiesen betrachtet werden, dass die verhältnismässige Wachstumsgrösse der einzelnen Knochen, der Schädeldecke sowohl als der Basis, bei allen Schädelkategorien sehr beträchtlichen Schwankungen unterliegt und innerhalb gewisser Grenzen von der Schädelform unabhängig ist." Other authors, as we shall see, are not so pessimistic about the skull base.

Reche (1911: 74-75) admits with Toldt that the chief difference between dolicho and brachy skulls lies in the build of the rear of the skull. But he extends this difference to the bregmatic region and introduces a new index:

$$\frac{100 \text{ L.B.}}{\text{Br. Op.}}$$

in which L.B. is the length of a perpendicular dropped from lambda to a line drawn from bregma to opisthion. He claims this index to be better for differentiating brachys from dolichos than the cephalic index; and besides it needs only the median sagittal plane for the diagnosis. Without criticizing this index too thoroughly — although one can hardly resist remarking that the part played by the bregma-opisthion diameter needs watching — we record for our present purpose that Reche holds that the parietal bones are also sufficiently different, in brachys and dolichos, to enter into the differentiation of the two types.

From a racial point of view Giovannozzi (1909: 114) had already divided the brachycephals of Europe into two types: the hypsi-cephalic, armenoid peoples (inhabiting mostly the territory of the Balkan Peninsula to Hungary, inclusive), related to the brachycephals of Asia Minor; and the platycephalic, monogoloid folk, one of whose centers was in the eastern Alps, especially in Carinthia and the Tirol.

Other authors keep insisting, however, on the mutability of the occipital region. Angelotti (1915-16: 29) concludes his study of dolicho- and brachymorphy by saying: "Ho mostrato anche che tali differenze interessano soprattutto la parte posteriore del cranio nella zona sopra-iniaca." Angelotti maintains that the two types, dolicho- and brachycephalous, are results of internal forces only. Zanolli (1914) and Giuliana (1921: 153) remark on the extreme variability of the occipital bone, a variability greater than that exhibited by any other bone of the brain case.

Mair (1926: 663) introduces a different approach, and an interesting one. He writes: "Das Windungsrelief der Aussentafel gibt beim Erwachsenen nicht immer den wahren Stand der Furchen und Windungen wieder, sondern einen den kindlichen Verhältnissen entsprechenden; die tatsächliche Form prägt sich nur mehr an der Innentafel an und zeigt in vielen Fällen einen ausgeprägteren okzipitopetalen Typus als der Aussenschädel." A detailed study inspired by this suggestion would be difficult to carry out, but might yield illuminating results (compare Weinmann and Sicher, 1947: 85). Even more fruitful, I should think, would be an extension of the work of Abbie (1947) who brings out (p. 241) a point of extreme importance, if corroborated: the ectocranial indices and the endocranial ones conform more closely throughout the ectocranial range of 79.8-82 than anywhere else in his series. This is one of the many reasons why Abbie takes this range for his mesocephaly, considering skulls above or below this range to be deviants from the original modern human form.

Mair's use of the word "okzipitopetalen" brings to mind Froriep's (1897) proposition of a fundamental difference in skulls with which every observer of man's physical variations has wrestled at one time or another. His

distinction between frontipetal and occipitopetal heads is echoed in Keith's (1925) preoccupation with the pre-auricular and post-auricular lengths; later on in this chapter, I shall return to this distinction, in discussing Davenport's (1940) struggles with a wandering porion and a growing post-auricular length.

Froriep's distinction keeps reappearing in the literature, because it seems based on fact. In 1926, Thorsch performed experiments to see whether it could be corroborated. He reports that a line dropped from the center of gravity of an ordinary set of skulls falls very near the porion; hence Froriep's dichotomy is valid.

However, some of the work built on this distinction does not impress me unduly. For instance, Shindo (1913: 711) claimed that in general uncivilized peoples were frontipetal and civilized, occipitopetal. As he draws this conclusion from observations on 37 skulls (17 "European," 3 "Asiatic," 2 "American Indian," 4 "African," and 11 "Oceanian"), one could well await corroboratory illumination from more extensive material. Until then, I preserve the liberty to say that this reminds me of the seductive but not too solid views of Nystrom (1902), that the differences of civilized and uncivilized heads were essentially created by living habits, such as work-posture.

Taking a very different direction, many craniologists have noted the phenomenon that the skull base remains relatively stable amid the vicissitudes that obviously affect the vault bones. Tschepourkowsky (1911) claimed that the skull base was from the very beginning of life racially differentiated. The Negroids, she says, have the longest, the Monogoloids the shortest skull base of those with like cranial index. She wonders whether the skull base may not be thus differentiated because it is intimately connected with the facial modulus. She adduces evidence from deformed and undeformed Peruvian skulls, in which there were spectacular differences in the vault, but practically none in the skull base. She also claims that the heredity she observes in the case of the cephalic index agrees with this stability of the skull basis.

Pfuhl (1924: 78) finds the pars basilaris of the skull the best for the registration of heredity in the skull region. His rather practical

reason for rejecting the vault for this purpose is that this region suffers considerably from birth deformations and from accidents occurring to the young skulls during transport and laboratory treatment, and from the vagaries of growth anomalies. He himself (p. 79) uses the dimension nasion-basion-inion as an expression of the skull length, and he avers that the cephalic index is even worse as an indicator of heredity in the case of the newborn than in that of adults. He claims that the skull depends for its form on the forces exerted by hormonal substances, and adds the somewhat difficult admonition that each skull should be evaluated as a whole.

Observations on the growth of the skull base have been made by Brodie (1940). It is clear from the graph he gives (p. 745) that the growth of the cranial base from six months to eight years has two phases. After 1.5 years of age, all the lines of growth, including this one, are straight lines. But not in the antecedent period. The early growth of the cranial base is irregular. On the whole, however, the patterns of growth are incremental, and the persistence of early characteristics is generally clear. This does not surprise us.

The apparent stability of the skull basis is the foundation for the correction formula for deformed skulls elaborated by Shapiro (1928). There is reason to believe that racial complications rendered his formula less than absolutely accurate; the material he worked with does not seem to have been perfectly adapted to his needs (von Bonin and Morant, 1938; Stewart, 1940).

That the skulls base can suffer considerable change in sympathy with deformation of the vault is suggested by Oettking (1924), who describes the declination of the pars basilaris in deformed San Miguel Island and Chinook Indian skulls as being greater than that found in miscellaneous European skulls; the angle of the foramen magnum also seems to be changed. The comparative material, in view of the racial factor, is unfortunate; but confirmation of the positional changes of the pars basilaris is afforded by Taeger (1930: 336); and Falkenburger (1938: 31-33) shows that the angle of the clivus is characteristically different in strikingly deformed and in normal skulls, while Stewart (1943: 167) demonstrates that the nasion-basion and nasion-prosthion

lengths can be affected by deformations of Peruvian intensity; Newman (1947: 14) feels that nasion-basion length could have been reduced 4-5 millimeters in a series of skulls with extraordinarily heavy fronto-occipital deformation. Results of limited deformation, of course, would not be particularly noticed in an ordinary craniological study, and the dimensions and angles would be included in the averages and ranges usually published.

However it may be with the skull base (and it would seem to demand a pronounced deformity to change it much), it is clear from many studies that the upper face, in particular, is little modified by deformations of the brain case. Rivet (1909-10), in his study of prognathism, found no relation between this phenomenon and any skull shape. Falkenburger (1938: 21-22) judged that the relations of the cranial and facial capacity in deformed and undeformed skulls indicated that the face is little affected in the course of deformation. Comparing his data with those of Rivet (1909-10) and Fraipont and Leclercq (1927) and Vandervael (1932) on cranio-facial comparisons, Falkenburger concludes (pp. 29-30): "Il en résulte que la conformation du crâne facial est beaucoup moins influencée par le procédé de la déformation artificielle que celle du crâne cérébral."

It is true that Stewart (1940: 158) tentatively notes (on the basis of few skulls) that his Whitewater Pueblos showed a somewhat broader palate when suffering from lambdoidal deformation than did the normal skulls. But Riesenfeld (1946: 89-90) found no correlation at all between cephalic index and palatal area or palatal index, although his series runs to high hyperbrachycephaly.

In general, the experience of students has been that the face pursues a relatively stable course through the vicissitudes of cranial deformation. Hooton (1930) did not observe any striking differences between the faces of deformed and undeformed Pecos Indians. Hrdlička (1931: 92), commenting on the skulls of Pueblos, Southern Utah Basket-Makers, and Navaho Indians, writes: "The deformed skulls, after elimination of the infrequent cases where the base and face were obviously affected by the distortion, show but little if any disturbances of the facial indices or angles, or of the size of the skull. The moderately deformed

skull is therefore, after all, of some anthropometric value." Of course, where the deforming method is also applied to the forehead, the upper face may possibly also be affected. Thus, Hrdlička (1940: 456), summarizing his conclusions on the Gulf States Indian crania in the National Museum, says: "In deformed skulls the facial indices tend to be lower, owing to the fact that the fronto-occipital compression has broadened the vault and with it the bizygomatic diameter." However, "The total facial and the alveolar angle appear to be, to a considerable extent, independent of each other." Outside of such cases, the bizygomatic width should not be affected, as is indicated by Seltzer's (1944) findings on various Southwestern Indian groups.

I shall make a slight digression here, to include observations on the living, in order to keep this brief discussion of the face unified. Boas (1911), interestingly enough, found that his American-born children of immigrants who changed their head form for a narrower one, also possessed smaller bizygomatic diameters. However, besides mentioning the fact that the differences were very small ones, we observe that such a difference is not universally found. Shapiro (1939) obtained an absolutely insignificant difference between sedentes, immigrants, and Hawaiian-born Japanese in this respect, even though the cephalic index changed by almost three points. Bean and Speidel (1923: 304) published the results of their study of a group of American soldiers; they found a difference of 3.01 points in the bizygomatic index (which I take to be the upper facial index) in favor of the subjects with flattened heads ($N: 38$) versus those with unflattened heads ($N: 397$). I suspect a racial complication in this case. In reverse, so to speak, we may quote Washburn (1946b: 172), who discovered in his experimental work on the rat that the form of the zygomatic arch had no direct effect on the form of the skull. Finally, I may adduce the results of my comparison of Lebanese and American Maronite upper faces, which show comparatively little mutability throughout the vicissitudes of change of cradling customs and change of environment.

A further compliment is paid the face by Pearson and Woo (1935: 463) who, in their detailed study of the individual bones of the

human head, found that the face was more symmetrical than the brain case. The factor of homology — the only one that seemed to elicit respectable correlations for them — shows to best advantage in the face.

In view of all that has been said of the face (including inter-racial comparisons in the case of brachycephals, of which more in the subsequent section), we come to the conclusion that the face should rank high in stability and in probity as a source of racial diagnostics.

Our chief concern in this study is with the varying fortunes of head form at an early age, specifically during the first year of postnatal life; later stages interest us only from the point of view of the persistence or nonpersistence of early form. Hence, the question of the part played by sutures (Weinmann and Sicher, 1947: 80 ff.) and suture-closure does not require extensive examination here. From the point of view of permanence or nonpermanence, however, we note that much modern opinion is to the effect that the sutures play a very subordinate rôle in fashioning head form (e.g., Troitsky, 1932: 530), and that suture-closure is not the cause of abnormal forms, but rather the expression of the fixation thereof (Mijlsberg, 1932: 550). Aichel (1926) reviews the literature up to his time and concludes that in a very limited number of cases suture-closure seems to cause the abnormal form; however, none of these forms is hyperbrachycephalic and planoccipital. Aichel has a useful table of abnormal skull forms (pp. 28–30).

I have already mentioned the importance of Hooton's (1930) monograph on the Pecos Indians to the conceptual background of this study.

Other studies on craniological material will appear in subsequent sections of this chapter.

The Problem of Brachycephalization

Strictly speaking, the problem of this study is that of the causation of hyperbrachycephaly. It is, however, impossible to set the essential boundary between hyperbrachycephaly and ordinary brachycephaly. It would seem possible that certain agencies of an external and mechanical nature are adapted, with a certain lessening of their duration, effectiveness, or rigors, to a production of brachycephaly on the nascent head. The agencies I have been discussing may become impious enough to

allow their effects to cross the numerical boundary line between the two categories. In addition, it will appear that the literature on the problem of brachycephalization contains much that might shed light on our central problem.

Our interest in this literature is not by any means motivated by a naïve desire to prove that early postnatal treatment is capable of solving the problem of brachycephalization. I simply cite such items from the literature as might indicate that this treatment may well have been one factor in the production of the interesting head form in question.

In view of the facts already submitted, and to be submitted, I cannot agree with Weidenreich's statement (1945: 41): "Recent man shows a tendency to become more and more brachycephalic. The development of hyperbrachycephalic forms seems to be the latest step in this direction." I am not against the tendency; I am for bounds set to the manifestation of that tendency.

Reicher (1914: 60-64) is puzzled by the fact that, when he compares the differences of the means for the brain case and the facial structure as between European and Mongoloid brachycephals, he finds practically no difference in the brain case, but a great difference for the face. He asks whether this could possibly be convergence; or should we consider the facial skeleton intrinsically more variable than the skeleton of the brain case? He concludes: "Wir können nur annehmen, dass die übereinstimmende brachycephale Form sich wahrscheinlich bei beiden Rassen unabhängig herausgebildet hat unter ähnlichen oder auch verschiedenen Einflüssen, die jedoch dasselbe Resultat bedingt haben." Reicher's weak explanation leaves the fact clearer that the purely metrical consideration of the two types of skulls is not at variance with the hypothesis that the brain cases have been affected by similar mechanical forces, whereas the faces show a racial difference such as one should expect between Europeans and Mongoloids.

The similarity in the occipital bones of Lapps, European Alpines, and Mongoloid brachycephals found by Blomquist (1939) would further increase Reicher's puzzlement. Because we know something of their customs, however, we may be allowed to feel that we have isolated one factor in the production of brachycephalic shape.

A similar phenomenon engages our attention when we turn to a part of the lengthy, detailed, but not too illuminating discussion by Gerhardt (1937-38) of brachycephaly. Here he is considering the relations of the Armenoid type of skull and the "Turanid" race. Gerhardt presents the difficulty against regarding the peoples of Pamir, and Hindu Kish, and Turkestan and of central Asia as members of the Alpine race; the unity, he well says, is merely that of brachycephaly—the rest of the somatic characteristics are quite different. "Es liegt vielleicht hier," he writes (p. 442), "ein ähnlicher Fall vor wie bei den alpenländischen und vorderasiatischen Planoccipitalen; auch bei diesen sind die Schädel ausserordentlich ähnlich, dagegen die somatischen Merkmale voneinander abweichend." We may recall here that such planoccipitals as the Maronites in the Lebanon and the Albanians and Montenegrins in the Balkans have identical cradling customs—which clearly produce this planoccipitaly in the case of the Maronites.

Kohlbrugge (1935: 71) states that the brains of brachycephals, all of them, show "une grande analogie," which he describes. There is no determinable difference, he says, between the brains of, e.g., Chinese and European brachycephals. Basing his conclusions largely on the work of Kappers (1932), Kohlbrugge (1935: 81-82) is sure that measurements are useless in distinguishing the different racial types of brachycephalic brains, and that the closer study of sulci and convolutions is just as meaningless.

It is far from my intention to venture onto the much-harried field of European brachycephaly as the protagonist of a simplistic theory. But I cannot ignore this field and its problem entirely. The "excessive brachycephalization which swept over central Europe in the Middle Ages, affecting especially southern Germany and Bohemia" (Coon, 1939: 10) is a phenomenon not entirely alien to this study. This is true in particular of outspokenly "Dinaric" regions; and also of regions containing a high percentage of hyperbrachycephals. At the very least, I have proposed a cultural factor which must be taken into account by the measurers of heads. Since I have demonstrated that a major Dinaric "racial" characteristic is nonhereditary, a re-examination of the problem of Dinaricization (Coon, 1939: 600-02) is in order; as well as of the

racial analyses made of Dinaric peoples. Such a re-examination, it is to be hoped, will shortly be made on Dinaries from Albania and Montenegro; a preliminary statement regarding planoccipitality and these peoples has already appeared (Ehrich and Coon, 1948), in which the non-racial nature of the flattening is emphasized. Ehrich was led all the more to this opinion by his comparison of the Atlanto-Mediterraneans and Dinaries he had isolated out from his Montenegrins; he found that significant x p.e. were found only for parts affected by cradling (Ehrich, 1947); this corroborated my own opinion that there was no such thing as the Dinaric race. It would seem that a factor in the influence on high brachycephaly of the Asiatic invasion of Europe (Hooton, 1946: 497-98; Weidenreich, 1945: 30) has been uncovered; that this factor may have played a rôle in the production of brachycephaly, too, seems plausible — for what can produce a drastic, striking result, can also produce a lesser result in the same field.

However far it may be from my intention to attempt to discuss fully European brachycephalization, a few samples from the literature on this subject will not appreciably distract us from our general theme; in fact, we may find some points of interest and value in these samples. The problem is attacked in numerous publications (e.g., Weidenreich, 1945: 21 ff.; Coon, 1939: 510 ff.). Županič (1937-39: 322-25) sets forth tables showing the radical difference in head form of the Yugoslavs of the seventh to tenth centuries A.D., and of the present. In 1919 (p. 22) Županič opined that the increasing brachycephaly thus indicated was introduced by the Mongols. Matiegka (1912) claims that the newer, brachycephalic Slavs grew out of the older, dolichocephalic ones. Others disagree with him. Schwerz (1912: 623) presents curves of the cephalic index for the Alemanni and for modern Swiss from the same area; these curves might have been copied from my own curves for the Lebanese and American Maronites. Much more impressive, however, is the information collected on the successive populations of Switzerland by the same author, and presented synoptically in a table (Schwerz, 1915: taf. 142). We note from this that Swiss populations from those of the Neolithic up to and

including the Alemanni, differ from the modern Swiss essentially in head form — but the indices and dimensions of the face have changed but little. It reminds me of the situation analyzed among the Pueblo Indians by Seltzer (1944). On the other hand, I may interpose mention of the fact that the faces of European and Asiatic Dinaries can be very different (Mollison, 1931-32; Krogh, 1938).

More concentrated attention has been paid to German brachycephaly by E. Fischer and his school than by any other group. It is, therefore, of some importance that we cite his views on the subject. He quotes (Fischer, 1924: 39) Ammon (1899) with approval: "Doch könnte die Kreuzung allein nicht erklären, warum die Körpergrösse des nordeuropäischen Typus und dessen Farben weniger beeinflusst wurden als die mit der Grösse in inniger Verbindung stehende Kopfform. Wenn nicht angenommen wird, dass die Auslese mitgewirkt hat, bleibt die Entstehung dieser merkwürdigen Verbindung unverstündlich." Ranke, says Fischer, proposed, and with justice, the leptoprosopic, brachycephalic type as the main racial type of southern Germany. Fischer (1924: 44) sums up his ideas thus: "Die Schädelform, d.h. die Grössen der Hauptdimensionen des Schädels sind an sich erbliches Rassemerkmal, d.h. beruhen auf Erbfaktoren, vererben sich also selbstverständlich nach den Mendelschen Gesetzen. Aber ebenso selbstverständlich wirken auf diese Merkmale die Umweltfaktoren ein, und der Phaenotypus, also das was wir mit Auge Massstab feststellen können, ist das Produkt beider Faktoren." These last are the "peristatische Faktoren" that Fischer proposes as an explanation of the anomaly of southern German brachycephaly. Gerhard (1937-38: 403) sums up Fischer's ideas even more dramatically, especially with regard to the value of the cephalic index in this whole problem: "Danach ist es unmöglich, dass die 'Brachykepalisation' hauptsächlich auf Einkreuzung der curv- oder planoccipitalen Typen beruht; auch eine Änderung des Genbestandes wird von E. Fischer mit guten Gründen abgelehnt, so dass nur ein phänotypisch wirkender Umwelteinfluss übrigbleibt, der uns aber *so gut wie unbekannt ist*. Damit ist aber in diesem Falle die Beurteilung eines Schädels (Kopfes) auf Grund des I.B-

Indexes so gut wie völlig aussichtslos." (Italics are mine.) I have, I think, proposed in this study one very plausible factor in the "Umwelteinfluss" which has become so important a consideration with regard to this problem.

Weidenreich (1945) sees in brachycephalization (no matter how abrupt it may be in various regions) a continuation of a general process which started a long time ago in the history of man's head, and continues to the present. That this has been the case he proves with many examples, most of them well known. I should be very happy to see this problem attacked by an experimentalist; for instance, an extension of the work of Schultz (1942) on the balancing of the head among the Primates to include various categories of modern heads would be one of the possible fruitful approaches to a factual evaluation of many theories on brachycephaly and the erect posture.

One attack on the problem of head form has been by way of studying the genetics of this phenotypical part of the categorization of mankind. The name that springs to the lips in this respect is that of Frets. According to him, the problem is not simple; I may well agree with him, and doubt at the outset that he is going to solve it by a multiplication of group, individual, and familial cephalic indices alone.

Frets (1925: 79) states that the factors for the three dimensions of the head cannot by themselves explain the heredity of head form. We must assume factors for form, as well as size. These factors are independent. The factors for head form show dominance, whereas those for head size are probably intermediate. For head form and head size Frets accepts an equal number of multiple (polymere) factors. For head form there is also multiple allelomorphism. Sometimes, in fact most of the time, brachycephaly is dominant. The situation is further complicated by the fact that the two sexes can differ in any mentioned respect.

In 1931, Frets (p. 516) comments on the findings of Roest who measured the children of Dutch and Javanese parents, and notes that brachycephaly is dominant in the cases in which the mother is the brachycephalic parent. In such a situation, I should like an investigation into just how much the mother, in these

marriages, follows native customs in rearing the child. Such matters are usually left to the mother, especially when the child is very young; the strong presumption exists that many Javanese are brachycephalic precisely because of early treatment. However, the point of Fret's remarks is at the end of his paper; there he states that he once found dolichocephaly dominant, and he asks: are we dealing with different forms of dolichocephaly and brachycephaly, in our sundry investigations? He returns to the old distinction between plan- and curvoccipital types, and concludes (as do so many scientific papers) with the plaintive remark that we need more data.

Geipel (1938: 126) holds that there is a pair of genes for the cephalic index, and that inheritance is intermediate. Mesocephaly is split inheritance. It is difficult to agree with Geipel, in the present state of our knowledge.

Neuert (1937: 145) notes that among the newborn of Europeans, the cephalic index of the infant tends to follow that of the parent with the lowest index. This is an interesting, and possibly important, observation.

Other authors are by no means convinced that simple Mendelian inheritance of head form, and specifically of brachycephaly, is a proven and clear process. With regard to the brachycephalization of Europe, Coon (1939: 10) writes: "Simple Mendelian dominance of brachycephaly, which has never been demonstrated, may not be eliminated, but it cannot have been the only factor involved." Brues (1946: 473-74) concludes from her study of various groups of European extraction in the United States that possibly dominance of brachycephaly is not at work in that country. Mühlmann (1932: 385) says that the dominance of brachycephaly is "keineswegs sicher." Abbie (1947: 239) may well write that "the inheritance of cranial characters seems to be a complex affair. . . ." The head breadth alone is the result of numerous factors; the posterior portion of the head is caused by still more. It is, therefore, on a very enigmatic genetical basis that Bunak's (1927) theory of the origin of the Dinaric head-shape was erected. This theory (developed and modified by Hughes, 1938b; Coon, 1939; and Kherumian, 1943) presupposes the inheritance of the anterior and posterior portions of the head, each "en bloc";

the anterior being of "dolicho" ancestry, the posterior of "brachy" origin, the fusion results in the dysharmonic Dinaric. Even apart from my proof of the deformation of the posterior head, this theory was bound to remain speculative, because of our current inability to separate out individual genic factors.

However, the frequent appearance of regularity obtained by such workers as Frets, Boas (1899; 1903), and many others, strengthens one's a priori opinion that basic head form should show obedience to the general laws of heredity. That head form is, indeed, not more irregular than it is, results from the working together of hereditary and nonhereditary factors (one of the latter may be infant treatment) towards the production of a normal curve, if I may so express it. The difficulty in isolating out hereditary and nonhereditary factors is highlighted by the painstaking study of Pearson and Woo (1935). These workers, using Egyptian skulls for material, made numerous measurements of the individual bones of the skull and then applied all their statistical resources in the attempt to discover relationships between the bones. They (p. 464) came to the conclusion that neither size nor contiguity yielded any discernible relationships; the only factor that seemed to eventuate in useful correlations was that of homology. They are forced to conceive the heredity of the brain case as being simply a matter of the heredity of the brain itself, which the brain case, as it were, incidentally covers. A glimpse of the complexity of the skull is given by Weinmann and Sicher (1947: 83), from a developmental point of view: the enlargement of the skull, they tell us, is primarily dependent on cartilaginous growth (as seen in the spheno-occipital synchondrosis, for example), on proliferation of connective tissue in the sutures, and on surface apposition of bone in many different areas. The third factor is the most important; but all three would certainly seem to allow many opportunities for individualistic variation induced by external forces.

The potential for drastic change resident in "environment" is indicated by recent work on twins. So, for example, von Verschuer (1931-32: 55; 1925) finds that there is a large difference between monozygotic twins with respect to the cephalic index, a difference that can

be attributed only to environmental forces. Abel (1934: 341) cannot come to any definite conclusion about the inheritance of head dimensions, but he does (p. 281) suggest that the deviations of the length and breadth of the head are greater for dizygotic than for monozygotic twins. The environment masks heredity, in great part. This stands out, too, from the pages of general studies, such as those of Newmann, *et al.* (1937; 1940), as well as from such striking individual examples as that published by Sullivan (1919) on the "Siamese twins" from the Philippines, whose indices differed markedly. It must be remembered, too, that environment does not wait for the time of birth, before getting to work. In fact, prenatal environmental influence causes a later difficulty in the diagnosis of monozygotic twins.

The obviously important action of environment on the human organism has often been handled under the catch-all heading of "Domestication." This has been thoroughly discussed in an excellent paper by Weidenreich (1925), who also gives a review of pertinent literature. Much attention has been given to the effects of domestication on animals; in this connection the names of Hiltzheimer (e.g., 1913; 1928) and Klatt (e.g., 1913) are complementary. Klatt, incidentally (463), makes a good but discouraging observation to the effect that we can determine racial characteristics on animal skulls only when we understand them causally. This is true, too, for human beings. That is, when racial characteristics are not just museum labels, but essential and dynamic knowledge.

The combined influences collected under the name of "Domestication" are not lightly to be tossed aside (Schwidetsky, 1940); but, on the other hand, in the present state of our knowledge, the limitations of this multiplex conditioning as an explanation are considerable (Mochi, 1921). The various elements that enter into its composition need more detailed study.

A few investigations on the effects of one or other factor in external environment have been made. One such is that of Iwanowsky (1925) on various groups in Russia that had suffered from a famine. He found that the cephalic index was lowered (with the exception of that

of some male Armenians, Grusines, and Tatars of the Crimea), but returned to normal for the most part by four months after the end of the famine. This is tantalizing. What exactly happened to the muscles we may well presume to have affected the head breadth? What would happen after several generations of successive (but not continuous) famines? Why did the exceptions occur? Changes in other respects have also been noted, although with less clarity, on the same sort of subjects by Stefko (1924). Hooton (1946: 495-96) compares the changes obtained by Iwanowsky, and those of Boas (1911) on immigrants and their children, and draws the conclusion that environmental differences, especially those affecting growth and nutrition, may thus alter the cephalic index by some two or three per cent. Nothing, by the way, so great as the changes I have found between the cradled Lebanese Maronites and their uncradled American descendants. It is hardly possible, at all events, that the small changes noted by Iwanowsky (which presumably occurred in the soft parts of the head) should be of permanent importance. Weidenreich (1925), however, points out that there may be great importance in long, successive generations of living under conditions which produce not exactly a sickness that may be diagnosed but a near-sickness that allows the subjects to live almost normally.

The possibilities inherent in the application of active experimentation on animals to the problems of anthropology have not been by any means adequately explored (Washburn and Detwiler, 1943; Washburn, 1946b: 169). Fick (1859) was a pioneer in this field, but the list of names of workers who have followed him up is short, and the years between the various publications many. The chief result of Gudden's work (1874: 34) was the realization of the reciprocity of accommodations between the brain and its bony capsule. In a general way, this realization emphasizes the importance of the contents of the capsule in exerting formative force on their container. It makes a skull, therefore, not just a husk which has autonomously and independently grown around a brain, but a product of its own intrinsic growth forces and those of the brain as well. Important as this concept may be in the realm of theory, its application to

our immediate problem may seem small in the present state of our knowledge. But I may interject that our ignorance also offers no reason why the posterior portion of the brain should tend to produce a flattened occipital bone.

Walkhoff (1903) studied the effects of excising the larger portion of the *M. temporalis* in the dog, and the resulting deviations in the temporal lines. Neubauer (1925: 415-24) has a long and capable description of the results of his tampering with the neck musculature in animals.

Of more recent date, the chief class of investigators interested in this work has been that of the orthodontists. We have already mentioned many items of their work in the discussion of the bigonial measurement on our Maronites. Naturally enough, these students have been chiefly interested in the teeth and the face.

The results achieved by evulsing teeth have been noted by many (e.g., Gudden, 1874; Du Bois, 1911), as well as the influences of the occlusion and eruption of teeth (e.g., Baker, 1941). Rouvière (1939), an anatomist, presents experimental work much like that of Walkhoff. Pratt (1943) removed the masseter muscle of young rats, and noted changes in their skulls as a consequence. Washburn (1946a and 1946b) has shown the changes resultant on the removal of the zygomatic arch and the cutting of the seventh nerve in young rats. A great deal of detailed work, including accurate statistical comparison of measurements of control and experimental animals, badly needs to be done. However, I think that such experimental work alone will not solve all our problems. I have noted, in discussing the bigonial measurement of my Maronites, that muscle influence seems to affect and sculpt what is already, in its main lines, laid down. While experimental work is important and needs doing, heredity and endocrinological studies must be joined to it.

General results of experimentation concerning the effects of nutrition on form and size have been made by physiologists, but not many have come to my attention in which measurements more or less applicable to anthropological problems are supplied. Such experiments, especially on young animals or on the effects

experienced by newborn animals of the feeding done by the mothers, should have much value.

Von Nathusius (1864) is one of the pioneers in the field of animal nutrition studies. He noted (pp. 100-01) that well-fed swine differed little from poorly fed swine of the same kind in length measurements, while the breadth measurements were often conspicuously different. Specifically, for our problem, the swine were more brachycephalic when well fed. Klatt (1913) notes that bigger animals tend to be more dolichocephalic. Neubauer (1925) found, on the other hand, that the rats which had been deprived of their rightful share of vitamins were all more brachycephalic (pp. 435-38). He compares his results with those of Henseler (1913-14) on swine; and notes the difference of technique used. Henseler fed his swine on a generally poor diet; Neubauer created specific vitamin deficiencies. It seems quite general that domesticated animals are shorter-headed than their wild congeners; it is hardly demonstrated that the nutritional factor is the sole or even the determining one in bringing about this effect.

Roth (1935) worked with alkaline injections of anterior pituitary extract, and with orally administered thymus gland. In general, the first led to giant growth; the skull length relative to body length became smaller, but the skull was absolutely lengthened, particularly the nasalia; the skull breadth was not essentially increased, but the bizygomatic diameter was much larger. The effect of thymus-feeding was quite different. The rate of growth was increased, but the animals did not reach the dimensions of the other set. The skull breadth gained somewhat; the bizygomatic diameter gained little. This study shows that there is a crying need for much more of the same kind of work.

One of the few cases of actual experimentation on living human beings, and one which is intimately connected with our problem, is that of Walcher. In 1905⁴, he reported on his treatment of 555 children born in the institution (a mid-wives' school) to which he was attached. These children were divided into groups: some were placed on their sides, with the sides of their heads resting on a fairly hard, horsehair-filled pillow. They were occasionally changed to the other side, when their heads showed asymmetries from being kept

too long on one side. The other children were placed on their backs, their occiputs resting on a soft, feather-filled pillow. The reason for the two types of pillows were: the hard pillow would make it uncomfortable for the child to rest the protruding occiput on it, and the child would tend to keep on its side; the soft, fluffy pillow would discourage the child from turning on its side, as the pillow would then interfere with breathing.

The results are reported by Walcher (1905a and 1905b; 1911; 1914; the last being a report of a lecture given on the subject before the Württemberg Anthropological Association), and by Elsässer (1906), and a résumé is appended to his own researches by Basler (1927). Walcher himself (1905a) is most jubilant over the reaction of two monozygotic twins, one of which became dolichocephalic, the other brachycephalic as a result of varied treatment. But I am more interested in the percentage table of results (Basler, 1927). Of those who had been placed on their back, 84.1 per cent increased in cephalic index, the amount being +3.75 points. Fifteen per cent showed negative results, by -1.39 points. The children who rested on their sides had 62.7 per cent whose cephalic index had been reduced, by an average of -2.56 points; 37.3 per cent showed negative results (i.e., negative for the desired and expected effect) by +.66 points. All this took place in thirteen days. Walcher (1911) insists that the greatest effect is made during the first weeks and months of an infant's life. He speculates on the effect of his discovery on the picture of man's cranial history, back through the ages. In this publication he also gives silhouettes of various children's heads, and good photographs of the twins involved in his best-loved experiment. In his 1914 reference, nothing new is added, but we note that he brought some of the children he had experimented on (now, no doubt, walking) for inspection by the Würtemberger anthropologists.

Many years later, Basler (1927) attempted to determine whether any effect produced during the extreme youth of these children had remained recognizable in adult life. Walcher's experiment was, in many respects, naïve. He never mentions any appreciation of the changes of the cephalic index that may occur within the first few days after birth, as

a result of readjustment after that process (a point I shall discuss in a subsequent section). He does not seem aware of any racial factor. Since he was a medical man, perhaps his lack of statement concerning pathological findings indicates that there were no such complications. The most unfortunate lack was that of properly kept records; Basler had great difficulty in locating the subjects of his experiments, in later years. However, Basler did succeed in tracking down twelve subjects with certainty, and he reports that these twelve had retained their modified cephalic index to a certain extent. Knowing more of growth studies than did Walcher, we appreciate the fact that he protested too much. He declared that the form of the head at the end of the first year of the child's life was the form that persisted throughout adult life. This is going too far. But, as will appear, one is justified in expecting a modified head form to be retained with the change of only one or two points, as a rule. This question of the permanence of youthful head form is not so burning a one as it was in the past; the literature on artificial cranial deformation and my results on the Maronites have shown, I think, that noticeable externally induced changes in the head form are sustained into later life. The question, if posed as regards less marked changes, will receive an answer in later discussions. In spite of the small number Basler could find for his follow-up of Walcher's subjects, the resulting impression from their combined work (an indication like a straw in the wind) is that early treatment can have a lasting effect.

Many criticisms of Walcher's work, and suggestions for improvements, have been published (e.g., Marlinger, 1912, who suggests that the children should be allowed to choose their own postures, and then divided on a hard and soft pillow basis), and many statements made concerning the unchangeable nature of the cephalic index (e.g., Pfitzner [1899: 376], "Der einzige unveränderliche Charakter"; and the conclusions of Pearson and Morant, already cited), but very few have resorted to further experimentation to prove or disprove the indications given by Walcher's work. And on the whole, anthropological literature, with the exception of an occasional small nod in the direction of what might be at best a very minor

factor in disturbing the metrical perfection of the cephalic index, has not been concerned with the whole matter.

However, Kruse (1934: 1755), after alluding to the universal change in cephalic index during the first year of life, insists on the strong influence of environment evident from twin studies. He claims that he, M. Fischer, and Catel have corroborated the results of Walcher. Kruse's own work was done on 14 subjects, and strong assertions are not to be founded on such a tiny foundation. Davenport (1940: 72) indicates, and rightly, that Kruse minimizes the importance of heredity in this problem. Davenport also adds a remark which echoes one of Hooton (1920: 89); namely, that children dolichocephals by heredity would find it more difficult to lie on their occiputs than brachycephals. So perhaps environment may often accentuate a hereditarily determined form; for the reverse could well be true of hereditary brachycephals. Certainly, the experimental work of the future should be much more meticulous than was that of Walcher. More refined categorization should be achieved; technique should be more accurately described — for instance, it makes some difference in this sort of study whether the head length is measured in the median sagittal plane, or wherever the greatest length is found, in the case of asymmetry.

Much more important than the work of Kruse is that of Catel and Grube (1934), although, sadly enough, it, too, suffers from lack of numbers. These two investigators employed a total of 30 children, 21 premature babies, and 9 evidently normal (p. 130). At the beginning of the experiment, these children varied in age from two to eighty-eight days; the experiment was carried on for from three to twelve weeks. There are, unfortunately, entirely too many papers published with statistical support of such a tenuous nature. Eighteen children were pillowed on horsehair-filled pillows and forced to assume a side-lying position; 12 were laid on their backs, their heads on soft pillows. In this technique, Catel and Grube were following Walcher's lead. Groupings that one could desire were not made: e.g., cephalic index groups with length of experimentation, state of nutrition, weight at birth, etc. The main criticism I should make of their work, however, is that the time of

experimentation was entirely too short to assure reaching satisfying conclusions. Their subsequent observations on the infants are valueless since there was a lack of control of experimental conditions (the infants had been returned to their homes).

On the whole, the conclusions reached by Catel and Grube are of two kinds: immediate and general. The first kind includes the statement that strong dolichocephals are more easily influenced to the opposite head form; that in the case of the brachycephals hard or soft pillows make no difference; while dolichocephals need hard pillows and then easily revert to type. The general conclusion: the head form of an infant can, with limits, be influenced, but only so long as the influencing factor is acting; by the time the definitive head form has been achieved, hereditary factors are of vastly greater importance than environmental. I disagree with the conclusions *as* drawn from the experiment; but I reiterate my stand that the heredity-element is a differential in this problem.

Catel and Grube, and many others, forget, it seems to me, the inherent complexity of any situation which deals with human heredity and environment. We never find a hundred per cent of any group on which head deformation is at work, to be deformed in the same way and with the same intensity; there are too many variables involved. An experiment concerning the subject in hand that would adequately deal with even the major variables should be a complicated and careful experiment indeed. And it badly needs doing.

General Anthropometrical Literature

I shall not delay long over conclusions concerning our problems, deduced from the anthropometry of single series. Only work which participates of the nature of the experimental is capable of settling the questions we are studying.

The conclusions of anthropologists have clustered about the central brand of opinion expressed by Coon (1939: 600); namely, that cradling may intensify an occipital flattening which is already present because it is hereditary and racial in character.

As neat a row of opinions as I have found is listed by Petroff (1931); his paper is con-

cerned with an area which is of great interest to us, the central Asiatic area.

Petroff cites: Oschanin and Jassewitch (1929) as thinking that the effect of the cradling is easy to discern among the Beshik, but that nevertheless there are some among them who are genotypically flattened, without the help of artificial deformation; Zimmermann (1927), who states that the flat occipital region of the Usbegs is completely an artificial product; Bunak (1932) who tends to think that the flattening is genotypical among the Armenians; Pokrowskj (1900), who opines that the possibility of cradling having some effect is proven, but that that effect is almost solely confined to asymmetries of the skulls; Anutschin (1887) as thinking it possible that occipital flattening be caused by cradling; Chantre (1881; 1891; 1895), who is sure that this is certain; as is Giltchenko (1890), in his study of the Ossetes; finally, Gerschenowitsch (1929), who remarks on the lessening of the amount of flattening as the subject grows older, among the Usbegs. It is this last point that determined Petroff to make a study of the phenomenon with Irani subjects.

Incidentally, opinions like these (although by no means unanimous among Russian anthropologists, nor confined to them alone) excited Gerhardt (1937-38: 414) to make the following scornful and erroneous remark: "Die besonders von älteren russischen Autoren immer gern beigebrachte Erklärung für die genannten hohen Indizes . . . , sie seien durch Kopfdeformation mittels der Wiege im frühesten Kindesalter verursacht, ist zwar bequem, aber kaum überzeugend, da eine derartige unbeabsichtigte Einwirkung sich kaum bis ins Erwachsenenalter erhalten wird. Ausserdem kann sie nicht in einem so starken Masse erfolgt sein." I think Gerhardt would delete that passage, now. In quite another area, that of the European Dinaries, Maleš (1938: 284) holds the hypothesis that Dinaric flattening may be due to cradling to be a thoroughly respectable one. Speaking very generally, Hooton (1946: 501) indicates that pressure on the occiput (or elsewhere) during infancy may be one of the possible factors in inducing the final head form.

To return to Petroff, who (1931: 505 ff.) studied the relations of age and occipital flat-

tening among the Irani. He finds that the length and breadth of the heads increase from age-group to older age-group, but that the flattening (p. 508) seems to be about the same at all ages. He obtains a general correlation between length and flattening of .76, and between breadth and flattening of .645. His final conclusion is (p. 509) that the cradle sometimes has remarkable effects on the racial form, but that the flattening is genotypical in some cases, at least most probably. I cannot agree with this last conclusion.

Müller (1935), dealing with the peoples of southern Asia, mentions artificial deformation, and specifically occipital flattening. But, he says (p. 85), this cannot have been caused merely by pressure on the occipital region, because there is no trace of effect on the frontal portion of the head. I think we have already disposed of this line of reasoning.

Since I have already had occasion to mention many studies and opinions drawn from purely anthropometric work, I shall not continue this discussion further, but will satisfy myself with the consideration of a comparative series (in addition to those already cited in Chapter II) which is cognate to our present study. That series is the one Boas (1924) proposes, comparing Asiatic and American Armenians. Boas gives data on 74 Armenians born and raised in Asia Minor and on 9 adult Armenians, born and raised in the United States, together with 7 children also of the United States. I consider here only the males, for purposes of strict comparison.

One notes immediately that the number of United States Armenians is lamentably small. On the whole, these series yield data comparable to my own. The differences, for the adults, are: head length, +6.4 in favor of the Americans; head breadth, -3.9, the Asiatic Armenians being broader; cephalic index -5.0, the Asiatic Armenians being 85.6, the Americans, 80.6. The seven children have an average cephalic index of 82.5.

So far, so good. We may reasonably assume that the Armenians, like the Maronites, gave up at least the larger share of their cradling habits when they migrated to this country, and that the head form of their offspring would thus be different. Boas (1924: 81) con-

cludes: "Der Unterschied der Kopfmasse zwischen beiden Gruppen ist so gross, dass es nicht wahrscheinlich ist, dass er auf dieselben Ursachen zurückzuführen ist, die eine Änderung der Körperform bei Italienern, Böhmen und Juden bewirken. In Anbetracht der bestimmten Angaben über die Behandlung der Kinder *darf man wohl annehmen, dass der wesentliche Grund in dem Wechsel der Behandlung zu suchen ist.*"

"Die Beobachtung des Hinterkopfes zeigt, dass viele Individuen eine starke Rundung zeigen, doch findet auch eine beträchtliche Zahl planoccipitaler Individuen, deren Köpfe nicht künstlich abgeplattet sind. Mit anderen Worten: die Behandlung des Kindes verstärkt den planoccipitalen Charakter, der aber auch ohne diese Ursache ziemlich oft in die Erscheinung tritt." (Italics are mine.)

I cannot agree with the second paragraph of Boas' conclusions. I am by no means certain what a "beträchtliche Zahl" of 9 subjects would be. I doubt that all vestige of the old-country custom of cradling was given up by the parents of the subjects; and this, together with minor anomalies, such as sleeping habits of the individual, would complicate the picture, even if the subjects of Boas' observations were many more than he actually managed to measure. I think a great deal more ruling-out would have to be done, before one could so blandly state that planoccipital types were genotypically so. I know that in every single one of the cases of peculiar head form, including the planoccipital, that I have been able to investigate with thoroughness, some obvious and external force has been applied, having been given the opportunity by, e.g., personal sleeping position preferences, illness during infancy, and the like.

Interesting tidbits from many anthropometric studies could be added to this section. One such would be von Luschan's (1891: 41) famous bimodal curve which indicates that one part of Lycia's population is positively long-headed, the other hyperbrachycephalic. He furnishes similar curves (von Luschan, 1911: 238) for Greeks, Turks, and Jews. Another interesting bimodal curve is that of Tschepourkowsky (1911: 159) for Russian women's cephalic index — their stature and facial index

curves being unimodal. It is tempting to interpret these phenomena as results of a differential infant treatment in the populations in question. But there is little use in speculating

on evidence for or against our thesis, in cases for which accurate knowledge of the factors and customs involved is lacking.

THE EMBRYOLOGICAL AND OBSTETRICAL LITERATURE

The influence of the fetal brain on the shape of the head is admitted by all. Father C. J. Connolly (personal communication) tells me that the fetal brain is indeed at first globular, but that he cannot agree with Macalister's (1898: 335) statement that the central, parietal, and temporal lobes grow more quickly than the rest of the brain. It is, however, a generally experienced fact that the fetal head is brachycephalic, and often hyperbrachycephalic. Many authors have given this situation their attention. Vilas (1929), desirous of checking on Retzius' (1904) work and seeing whether Retzius or his opponents were correct, found moderate brachycephaly in the fetus from three to nine months, and says (p. 705) that at least for the first six or seven months of fetal life, there is no noticeable racial difference with regard to the cephalic index. However, Vilas was presumably dealing with Viennese subjects (although he does not give racial data). Lecourtois (1869) triumphantly confronts Welcker (1862) and Schaaffhausen (1866), who had pronounced for the brachycephaly of the fetus, with the fact that there could be cases of dolichocephaly among fetuses, because he found some in Paris. In spite of the small number of subjects, those who are accustomed to dealing with arithmetic means are not so surprised at this as Lecourtois was pleased. Schultz (1926) shows that the average of 200 white fetuses of the third and fourth month is hyperbrachycephalic.

If I understand the measurements of Calkins (1922) aright, his rearrangement of the data allows him the conclusion that the fetus is dolichocephalic at the beginning (23-50 C-H L) group, gradually rises to an index just below 80, and then stays there. His groups are made up according to the crown-heel length. He claims (p. 128) that the relationship between any two dimensions of the fetus is according to the formula: $y = ax + b$, where x and y are the bodily dimensions in

question, and a and b are constants. He states (p. 129) that a definite rate of growth has been established by the third month, and is maintained during the rest of prenatal growth. His position is that birth molding probably leads to much greater changes in head dimensions than is usually thought the case. Father Connolly (personal communication) is quite definite in stating that there is an occipital lengthening near term or at birth, or both.

This is as good a place as any in which to introduce a short note of theory concerning the growth of the bones of the skull. I have already mentioned some general expressions of opinion concerning the relations of function and form, muscle and bone (Chapter II, in connection with the growth and sculpture of the mandible). Here we are dealing rather with the relations of part to part in the initial and early growth of the bones of the vault of the head. These are membrane bones, usually opposed in standard classifications to the cartilage bones. Mainland (1945: 84) remarks that this classification has overstressed the opposition between the two types of bones, because all ossification occurs in connective tissue; because craniocleido-dysostosis affects many cartilage bones, as well as membrane bones; because the reason membrane bones have poor regenerative powers is probably the early closure of their period of active growth (the head being in advance of the rest of the body in this respect [compare Weinmann and Sicher, 1947: 55]).

But here I am dealing with the mechanical relations between capsule and contents. Thoma (summarized by Weinoldt, 1922: 312-14) believes that any bone has the power of growing in any direction by interstitial addition of parts. In the case of the skull, the contents exert pressure in all directions, but obviously the skull does not grow equally to a perfect sphere. So, in order to explain the tubera, he elaborates his "Druckpolentheorie"; namely,

that the fetal brain must speed up or intensify its pressure on certain points or areas at certain times. The stresses on the fetal vault bones, unlike the stresses on the long bones, are not pressure-stresses but tension-stresses ("Zugspannungen").

Weinoldt (1922) disagrees with Thoma specifically on his "Druckpolen." He points out that the early, purely epithelial fetal "skull" is globular, but that with the onset of ossification at the centers, the adult shaping begins. He also points out that an equal pressure in all directions, which is about all we know of the activity of the fetal brain and its concomitant liquids, does not explain the ossification of the various vault bones. He adduces pathological cases (pp. 316-18), in which at birth the brain is little more than a bladder filled with liquid, but the vault bones of the subjects are moderately normal in structure. This is backed up by numerous examples in Murray (1936). In cases of anencephaly (pp. 319-22) there is no influence of the nonexistent brain on the vault bones, yet these bones are all clearly perceivable, although not normal. Weinoldt emphasizes the important fact that the walls of the cranial case are attached to the base of the skull, and he ties this in with the arching of the vault and the bending of the basis. One is reminded of the striking photographs of Thomson's (1903) experiment with a skull base and a bladder, gradually filling with air; except for the saddening fact that that experiment, dramatic as it was, proved nothing. There is more to racial and developmental differentiation of the skull, as well as idiosyncratic development, than such simple factors. But, Weinoldt continues, the vault bones are not everywhere of the same build: where the falx is attached, there is a strengthening of the bone, due to resistance to tension. So the areas of expansion are between the base of the skull and the attachment of the falx. Here the centers of ossification are found, and they lead to the formation of the sundry tubera. Specifically concerning the occipital, he indicates the influence of the falx and the tentorium, and also the fact that this region suffers the first real tension to come from outside the skull, namely that of the neck musculature. He concludes (after a consideration of suture-closure which does not especially in-

terest us at this point) that the first conditioning of the bones is by hereditary factors; afterwards mechanical forces make themselves felt. This conclusion is much the same as the general remarks about Wolf's Law we presented in Chapter II; and the over-all picture of the mutual interworking of capsule and contents proposed by Gudden (1874) still remains conceptually important, even if both of these two are again broken down into two aspects, the hereditary and the functional. How obscure the final result is, at least to statistical study, is proven by the study of the individual bones undertaken by Pearson and Woo (1935).

Weinmann and Sicher (1947: 43) disagree completely with Thoma, and state that one of the most important advances in our knowledge of bone development is the demonstration that there is no interstitial development of bone; growth of bone occurs only by addition of bone to free bone surfaces, i.e., by appositional growth. We have already noted how compatible this concept is with the findings of Pearson and Woo. Specifically with regard to the growth of the bones of the skull during the early years of the individual's life, Weinmann and Sicher (1947: 87) claim that growth in size of the individual bones is achieved by apposition of bone in the sutural areas, but the necessary flattening (in keeping with the increase in radius of the growing brain) is brought about by resorption of the inner surface of the bone near the sutures plus apposition of bone in the central area of the bone in question. It would be interesting to see a detailed study of the internal structure of the occipital in flattened and unflattened skulls. Glücksmann (1938: 107; 1942: 238) has shown that pressure and tension can produce orientated bone structure in unorientated osteogenic material *in vitro*; one should suspect, therefore, some discernible difference between occipitals that have been subjected to early pressure and those which have not been so influenced.

Vilas (1929: 708-12) found that the intensity of breadth growth of the skull increases for the period included by the third to the fifth fetal month, then quickly decreases to about half of this intensity, and remains constant during the subsequent time of gestation, beginning with the sixth month; the length always gains more than the breadth (with rela-

tion to the cephalic index), but particularly around the time of birth. These findings seem never to have received an explanation by any other investigator. Shilova (cited in Field, 1948: 237-38), studying 725 embryos and fetuses, found a constant rise in cephalic index during uterine life. In 339 cases (56.2 per cent), the newborn infant was brachycephalic (80.0-84.9); during the first three months the cephalic index increases, the predominant form being mesocephaly; from the fourth to the tenth month the index varies slightly, but the predominant form is brachycephaly.

The general experience, however, certainly is that the newborn head is not as brachycephalic as the adult head, for the same population. Just when the head achieves this higher index will be pointed out in the next section. Kruse (1934: 1755) tells us that all over brachycephalic Germany, infants brought into the world by a Caesarean section average 81.5 in the cephalic index, but the infants born normally are universally 79. Kugler (1931: 431) studied 250 male and 250 female newborn infants in Zürich, and finds their average cephalic index to be respectively 77.0 and 77.9, although, of course, the ranges were enormous (69.1-87.5; 67.5-91.8). Freeman and Platt (1932: 71) give the head lengths and breadths of various racial groups, for which I calculate the following cephalic index values for the males: Americans, 81.7; Germans, 78.5; Poles, 80.2; Jews, 81.3; Swiss, 75.9; more Americans, 79.8. Bakwin and Bakwin (1934: 613-14) supply measurements for American infants, first-born and later-born, from which the cephalic index of 79.1 and 79.2, respectively, emerge. Abbie (1947: 250) sets the neonatal cephalic index in the lower 80's, but in general it should be slightly lower. His own 39 European infants average 78.4, and Ranke's 20 (mean of 81.5) range from one to twenty-one days in age, thus ignoring a precaution in measuring newborn infants' heads which will be discussed below. More examples may be found in Krogman (1941b); and Davenport (1940) will be cited in another connection subsequently. We can, therefore, agree in a very general way with Neuert (1937: 145) when he says that the newborn children of even predominantly brachycephalic and hyperbrachycephalic parents definitely tend towards dolicho- and

mesocephaly. This is an important point in our understanding of the history of head form.

The suspicion has no doubt been created, that this sudden trend towards dolichocephaly is caused by the influences exerted on the young head during the process of birth. This problem has been studied by obstetricians, and their general opinion, so far as I have been able to discover, is that deformations of the infant's head occasioned by normal birth experiences are transitory in nature.

Vogel (1924), for instance, made a study of newborn infants who had had normal births. He measured these subjects as soon after birth as possible (the latest was ten hours in the world), and then again on the eighth day after birth. He concludes that the head of the newborn infant is not elastic, but plastic. It keeps whatever change in shape has been forced on it by the process of birth, but gradually loses most observable deformations by the eighth day. His warning, that there is in almost every birth some deformation of the head, makes one wish one had more accurate knowledge of just when some investigators had measured their subjects. Vogel points out, as did Budin (1876a) very clearly and long before him, that in some births the bones of the skull can be forced to overlap each other. Only in the worst cases does one parietal bone slide over the other, while in the lightest cases of deformation, the parietalia (one or both) can overlap the occipital. Premature babies seem to experience the more serious deformations. These are caused, primarily, according to Vogel (p. 159), by the soft parts involved in the process of birth, because all these deformations can and do occur in cases where the mother's bony pelvis is perfectly normal. But the bony pelvis may play a further part in deformation, as is especially the case with abnormal births (p. 167).

Backer (1891) noted the influence of the different states of fontanelles, sutures, and rigidity of bones of the skull on the newborn's head, and also claimed to have noted a narrowing of the head of the infant if the mother's pelvis had been narrow. Müller (1907, and many other papers in the *Archiv. f. Gyn.*) arrived at the opinion that the general shape of the skull was hereditarily conditioned, but that the dimensions and shape of the skull

could be varied within narrow limits. Stumpf (1907) also mentions the ministrations of the obstetrician as a factor in head deformation. Müller (1907) and Kehrer and Lahm (1920) and Wehefritz (1928) and Stratz (1921) all agree that the process of birth usually leaves only transitory deforming effects on the infant skull. Henkel (1934) gives photographs of some startlingly deformed newborn heads, and also those which show how these deformations are lost within two to four days after birth. This has been the experience of many fathers and mothers—to their great relief. Neuert (1933: 240) investigated the relations of various head forms to the position of the fetus in the uterus and the type of presentation at birth, but I do not judge these conclusions to be of particular importance to our problem. I think, however, it is of moment that absolutely none of these authors speak of any form of flattening of the head as entering into the picture of birth deformations. Davenport

(1940: 69-70) reports on the unpublished dissertation of Tiber (1930), who investigated the influence of "birth-molding," and concludes that the sagittal-oblique (sub-occiput to bregma) is perhaps the dimension which is most changed (in this case reduced) by the muscles of the walls of the birth canal, in cases of normal vertex presentation. Scammon and Calkins (1929: 98) state the reduction to be on the average 9 millimeters, but this amount is restored during the first ten days of postnatal life. The fact that the average cephalic index of infants is reduced somewhat during the first two or three days of that life (Kugler, 1931: 564) indicates that the head breadth is slightly and temporarily increased by the birth-process.

On the whole, until some new evidence forces us to another conclusion, we cannot assume freely that any radical changes towards dolichocephaly are caused by the normal processes of birth—rather, the burden of evidence is in favor of the opposite conclusion.

THE LITERATURE FROM PEDIATRICS, AND GROWTH STUDIES

The most interesting and pertinent phenomenon of postnatal growth from the point of view of our present study is the fluctuation of the cephalic index during the first year of life. Infants are mesocephalic, for the most part, at birth. The brachycephalic groups of the world arrive at adulthood with this index changed to a much higher one. Most growth studies, taking the children from five, or ten, or even two years of age on to adult life, emphasize the fact that the cephalic index varies little during the period subsequent to the first year of life. Both Davenport's study (1940) and the data of Bayley (1936) show what happens during the critical period of postnatal life with respect to the cephalic index. What happens is very intriguing (fig. 8).

The infants (in this case, Americans), starting at birth with an index somewhere between 76 and 79, experience a *very rapid increase* in cephalic index until at the age of eight or nine months they have become hyperbrachycephalic. Tschepourkowsky (1911) noted the same trend in Russian babies during the first six months of their postnatal life. Then the cephalic index takes a fairly sharp bend down-

ward to low brachycephaly, where it evens off at about 81.

This a very peculiar pattern, and it is all the more peculiar when we consider the concomitant growth curves. The human growth curve, for absolute measurements and weights, is uniformly the same, no matter what characteristic is observed. As Weinbach (1941: 219) says: "From birth to puberty the course of growth in body weight, although made up of a decelerating and an accelerating portion, shows no discontinuity, and there is no physiological evidence of any modifying influence on the course of growth." At puberty, there is obvious manifestation of the internal disturbances caused by the endocrine glands. There is no evidence of any such disturbance when we regard any characteristic of the growth curves of the first year of life.

The curves for the growth of head length (Davenport, 1940: 7), and for head breadth (p. 17), are of the same nature. Yet Davenport (p. 8) well says of head length: "Hardly another dimension of the body is so precocious in its development as to be three-quarters finished at 6 months post partum." And of

head breadth (p. 18): "Thus the amount of growth of head width is at first about the same as that of head length, but *after 2 years* slows up greatly." (*Italics are mine*)

If we turn to the growth curve of the human brain for this period, as exhibited in brain weight, we find (Scammon, 1936: 150) the whole brain growth in weight from zero to twelve months an absolutely straight line; and the same is true of parts of the brain, the cerebrum (p. 152), the cerebellum (p. 154), and even the brain stem (p. 155). In addition to the regularity of growth in weight, Brodie (1941) has shown that the growth of the young skull is completely concentric and regular.

is usually laid on its back. Only at five months does the normal infant roll over into another position, without being assisted in the act (Aldrich and Norval, 1946: 305). It is interesting to note that the normal, average American baby begins to walk with help at 9.5 months (p. 306) — and it is at this newly active period that the cephalic index begins to be lowered. At twelve months, according to Aldrich (p. 307, although she admits that all other authors put this date somewhat later), the average infant walks alone, at least for a few steps. At any rate, this period of the first year of the life of an infant, i.e., from nine to twelve months, is obviously a time for intense and

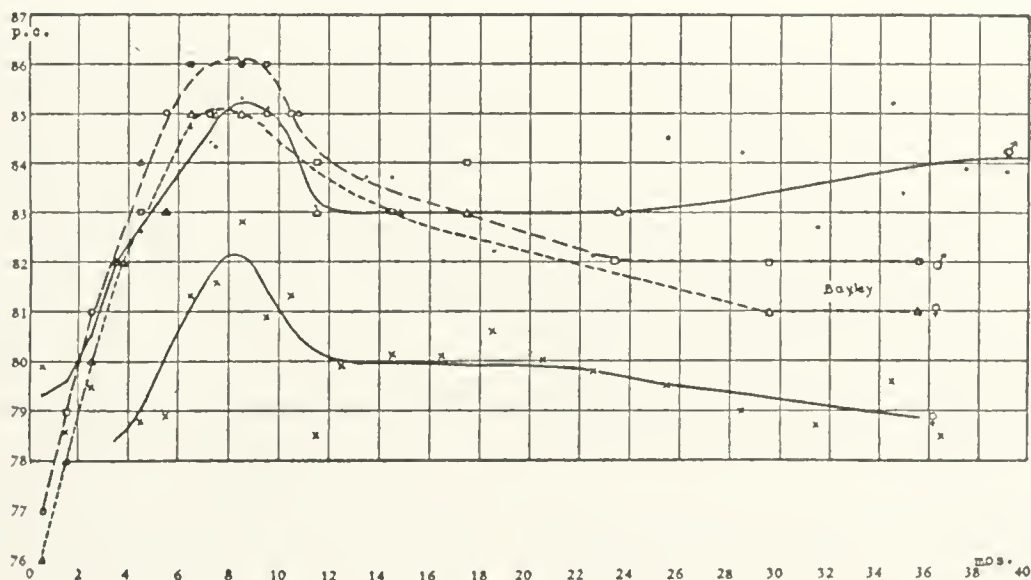


FIG. 8. Mass curves of change with age of cephalic index, babies only, male and female. Unbroken lines, Babies Hospital, males above, females below. Broken lines, from data of Bayley, 1936. Abscissae in months. (From Davenport, 1940, fig. 49, p. 63.) Courtesy of the American Philosophical Society.

There is evidence here of no disturbance in the regularity of growth, but there is a disturbance in the cephalic index. A change from 77 to 86 to 81 is quite a variation up and down the scale. I submit that, until some evidence of internal nature can be adduced, the possibility of this disturbance of the cephalic index being caused by mechanical and external factors is very high indeed.

Now, unfortunately, I have no data on the way these infants studied by Davenport and Bayley lay in their cribs. But the average baby, unless deliberately turned, or placed on its stomach, lies in the position he is put in, and

mobile activity on the part of the child. It is the period when it begins to crawl and then walk. It is interesting to note that Walcher (1905a), too, found difficulty in keeping his experimental babies in a predetermined position while sleeping, from the ninth month of their life.

Bayley (1936: 8-13) is inclined to regard external mechanical forces as very important in the molding of the head form of the infant. In view of the dramatic results obtained by the Maronites in cradling, we should not be vastly surprised if less drastic methods of incomplete immobilization should produce some, even if

much slighter, effects. Bayley attempted, specifically for our problem, to rate her infants on a seven-point scale of activity at twelve months, and to correlate these observations with the cephalic index. On that basis, one could expect only a most crude correlation. The coefficient she got was $-.39$, and she concludes that "pressure on the back of the head does have some influence in changing a child's cephalic index" (Bayley, 1936: 11). But Davenport (1940: 73) does not seem impressed with the efficacy of Bayley's technique in this case. He himself (p. 74) compares the head height with breadth, length, and cephalic index for four boys and four girls "known or believed to have been bed-ridden," with normal averages. These eight subjects were measured at ages from twenty to twenty-seven. Davenport gets results which show only a little difference between bed-ridden and normal subjects, by averages. However, not only are his numbers small, but I find among his bed-ridden subjects such eccentric indices as 84, 87, 94, 95 — a large number for any normal American population; *and*, neither Davenport nor I know anything about the position normally assumed by these people in bed. We need a great deal more information on this subject, and I am sure it is a fruitful little field for investigation.

Davenport (1940: 23-31) also studies the head height (as he does a whole row of measurements and indices): his infants exhibit a small sharp deceleration of the growth curve (p. 25) at about one year of age, and a dip in head height between three and five years of age. He attributes the first deceleration to gravity. This does not completely satisfy me. There might well be a factor of compensation here. His treatment of the relations of head height and head length (pp. 76-83) does not illuminate the situation for me. Davenport studies other parts of the head and face, and presents a thoroughly excellent and important paper; these other considerations are not, however, pertinent to our study.

His work on the pre- and post-auricular lengths of the head, however, is of value here (pp. 47-53). The growth-curve of the post-auricular length shows the same general shape as all other growth curves (except that of the cephalic index) in infants, with a noticeable

dip, however, at around eight to nine years of age. The particular time that interests us is thus described (p. 47): "During less than 6 months to birth the post-auricular part of the cranium increases 40 mm. or at the rate of about 75 mm. p. a. During the first post-natal year the average increase is, in the male, from 59 to 81.7 mm., or at the rate of 22 mm. p.a. This year is characterized by a marked bulging of the occipital bone." Here again, we have an apparently natural process which does not in any way explain the changes in the cephalic index we have noted.

The curve comparing the post-auricular length to total head length is a peculiar one (Davenport, 1940: 95), with a tremendous trough following a maximum reached at birth; the line then rises from two to three years, and almost comes back to the level of the birth-maximum at three to four years. Some of this eccentricity is caused by the migrations of porion, already noted by Neumayer (1908; compare Martin, 1928: 707); and these migrations also condition head height, because the migration is downward as well as towards the rear (p. 53).

Davenport's (p. 75) final conclusions with regard to the cephalic index are: "The causes of the great increase in brachycephaly during the first post-natal year are uncertain. There is some reason for thinking that the habit of sleeping on the back of the head may cause it in some cases. The most probable cause in the latter half of the first post-natal year is an increase in width dependent on the flattening of the brain and brain case that accompanies the acquisition of vertical posture." However, a glance at his curves will show that the latter half of the first year but continues the process begun during the first half, until the picture radically changes after nine months.

That the head then, after the first year, settles down to a shape that will be but slightly changed until adulthood, is shown by the results of a myriad of investigators. The changes that are exhibited by some groups are considerably larger than those of others. Much detailed work, not merely of measurement of wholesale and indiscriminate groups of children, but of painstaking correlations with all sorts of factors (for instance, sleeping habits), will have to be done before the pattern

of the cephalic index change with growth will begin to mean much, in causal terms.

Information concerning the fusion of the various bones of the skull does not seem to throw much immediate light on the process of growth of the head, or on the relations of growth to the cephalic index. The various parts of the occipital bone fuse between the second and the fourth year of life (Hasselwander, 1931: 474), but the squama of the occipital is already a unified bone at birth (except for specimens having wormian bones—Martin, 1928: 838). In place of the future suture there are septa of fibrous tissue continuous with the pericranium externally and with the dura internally. As yet the bones of the skull are not differentiated into the two tables separated by diploë of later life (Pancoast, *et al.*, 1940: 59). The occipital fontanelle exists at birth (it closes late in the first year of postnatal life), but it is not very large. I have no information on the plasticity of the newborn bone or on the tensile strength of the fibrous tissue. By the fourth year the head is much what it will be in adult life, with the exception of effects produced by a later small relative growth in length.

Hellman (1932: 790) arranges children in a series based on stages of tooth eruption. His subjects showed an average cephalic index of about 78.7 at an average age of 5.53 years, and one of 77.8 at 20.83 years.

I shall now very briefly list a number of studies on the cephalic index according to age differential, among males of various peoples. Working on 100 *French* boys, Godin (1935: 184) obtained a cephalic index of 82.21 at thirteen and one-half years, and one of 79.2 at twenty-three years. Ranke (1905: 174) found the following indices for various ages among the 2509 *German* male children he studied: birth to twenty-one days, 81.5; one year, 83.9; two years, 82.5; three years, 84.8; fifteen years, 81.8. Kretschmar (1932) compares *German* and *Swiss* thus: at ten, 83.6 and 84.3; at nineteen, 82.4 and 83.0. Schwerz (1911) found a difference for *Swiss* (Schaaffhausen) of 0.9 points, between a cephalic index of 83.2 at six, and 82.3 at twenty.

The studies on *Americans* have been numerous. Freeman and Platt (1933: 196–204) give the cephalic index by months and years to

eight, and by years thence to fifteen. Their figures commence with a cephalic index of 82.83 at the second month, and at the end of fifteen years it is 81.83. Gray and Ayres (1931: 72–108), studying Chicago private school boys, have 83.0 at the first year (more accurately put, at 0.5 to 1.5 years), 81.0 at the fourth year, 79.3 at the fifth year, 78.9 at the seventh year, 77.9 at the nineteenth year. Lucas and Pryor (1935: 540–43) indicate that California boys under one year have a cephalic index of 82.6; at one, 80.6; at two, 78.9; and at fifteen, 80.0. The Iowa Child Welfare Research Station (1929) figures follow the same pattern for their children from three to six years. So does the series of Meredith (1935: 23–24), who gives head lengths and breadths for Iowa City boys. Bayley (1936: 10) presents an interesting comparison of first-born and non-first-born: the first-born at one month have a cephalic index of 77, and of 82 at thirty-six months; the non-first-born, 77 at one month, and 81 at thirty-six months. Not much difference between the two groups is indicated.

For the *English*, we may cite Myers (1926: 92–93) on London children, as follows: at six months, 81.3; at twelve to fifteen months, 78.7; at twenty-one to twenty-four months, 78.5; at thirteen to fourteen years, 78.0. This differs considerably from the results found by Pearson and Tippett (1924: 120), who discovered no difference for English male children, comparing those of an age of 4.5 years and those of 20.5 years; although they did discern (p. 125) a slight difference for females. It is likely that sampling has a great deal to do with discrepancies like these.

Morros Sardá (1934), it is true, reports an amazingly homogeneous series for *Spanish* children: at six years, 77.8; at fourteen, 77.0. The pattern that Appleton (1927: 250–51) depicts for the *Chinese*, on the other hand, is a puzzling one. She has three series, one of Chinese boys in Hawaii, one in East China, and one in Kiangsu. All three series show a break in the direction of reduction of the cephalic index. The first two have a break of practically three points at eleven to twelve years and eight to nine years, respectively; the third shows a similar change at nine to ten years, a change of two points.

The general pattern, however, is repeated in Hirsch's (1927: 83) comparison of Boas' foreign-born and American-born *Jews*, and his own series of American-born *Jews*. Herskovits (1927: 305) finds among the *American Negroes* a cephalic index of 81.17 at the age of one, 79.33 at two, and his adults ($N=961$) have a cephalic index of 77.09.

Finally, Keiter (1933: 346) and Wissler (1930: 126-27) give synoptic tables for various groups, and the general pattern holds throughout. Still more tables are contained in Krogman (1941b).

The picture, then, is fairly clear. The human head goes through a disturbed period in the first year of life, but soon settles down to a cephalic index which differs but little from the adult index. And if we had some method of measuring a cephalic index without includ-

ing the supra-orbital ridges of the male, it would in all probability be even more stable. At all events, *except for that first year*, the cephalic index behaves in a very sober and orderly way. During the first year, it reverses itself in an unusual manner. I suggest that a large factor in this procedure is infant bedding.

I wish also to emphasize that, subsequently, the cephalic index is normally reduced very little or at most two points, and that it is normally somewhat greater than that of the newborn. Hence, it would seem that the cephalic index is quite generally affected by external forces. I suggest that an accurate assessment of such forces must be made for individual populations before it can be said that our knowledge of the normal adult cephalic index and its causal relationships is complete.

MEDICAL LITERATURE

In considering the medical literature I have omitted delving into the obviously teratological; I have not contemplated such phenomena as the turriccephaly (Pancoast, *et al.*, 1940: 81-82), and the like, since these are easily recognized. There is no reason to believe that the whole Lebanese Maronite series was composed of pathological cases that no one could avoid diagnosing. The syndromes of such moderately rare and very easily diagnosable diseases as include planoccipitaly or hyperbrachycephaly are of such a nature that, even if the patients managed to live until adulthood, no anthropometrist would select them as normal subjects for a series. Examples of such diseases are: acrocephalosyndactyly (Buckley and Yakovlev, 1948), cranio-facial dysostosis (Crouzon, 1935), and Mongolism (Ingalls, 1947).

There are several diseases, however, which have a direct positive connection with the problem we have been studying. One of these might well be rickets, or craniotabes in the case of the skull. Münch (1935) has investigated this very point among German children. The diagnostic signs of craniotabes are: a thickening of the suture regions, and especially a thickening of the tubera frontalia and parietalia, and, in general, the *Caput quadratum*

(see also Pancoast, *et al.*, 1940: 186). There are also diagnostic signs of rickets in the other parts of the body, of course, so that even without a clear-cut picture being obtained from the head, one may tell whether the child in question is rachitic. Münch shows that non-rachitic children had a lower cephalic index than those afflicted with the disease. But the cranial diagnostics themselves, according to her, have only a very small effect on the cephalic index.

Ylppö (1919) studied the course of craniotabes in premature babies. For them, he concludes, the period of this disease lies within that from two to twelve months of age, and it definitely conduces to occipital flattening. Peiper (1923) uses flattening as one of his diagnostic criteria in judging whether or not the patient had had rickets at an early age.

It seems certain that early rickets (plus the normal pressure of the infant's head on the pillow) can assist materially in the production of occipital flattening (Weinmann and Sicher, 1947: 263). Hence, this factor would have to be taken into account, when diagnosing a population with respect to the cephalic index. In the case of my Lebanese series I can state with considerable affirmation that there is no indication of early rickets. Nor was there any

in the 254 Maronite skulls I studied while in the Lebanon, except for two very doubtful cases, in which the characteristics could well have been produced by a different disease and probably were. With regard to the 40 skulls scrutinized by Melconian and Schaepelynck (1947), these authors (who are medical men) specifically rule out oxycephaly, acrocephaly, plagiocephaly, and syphilis, and mention no other pathological manifestation. Incidentally, they reject the possibility that early cradling may have caused the occipital flattening noted in 17 of their skulls; they hope later to be able to study the brains from such skulls, and expect to find in some disease the cause of the deformation. I am permitted to doubt, at this late stage in our discussion, that it will be along this path that they will come on the true cause of occipital flattening.

Finkbeiner (1923: 59-60) shows from data collected by Scholz (1906) that cretins in Germany are very brachycephalic, the average cephalic index for males being 86.5. Quite probably he is correct in thinking that cretins

have a higher cephalic index than has the surrounding population; but he does not analyze the racial factor in his material.

That there might be a connection between thyroid disturbances or deficiencies and brachycephaly is indicated by Lang (1928: 48), who concludes from his investigations in Munich that the hyperbrachycephals show a definitely higher incidence of goiter than do the dolichocephals. Weidenreich (1925: 41) refers to the data of Müller (1925: 1) on the very brachycephalic Tirolese, among whom 46.7 per cent of the male children and 54.0 per cent of the female children suffer from goiter. Similar results were obtained specifically in the Volksschule of Innsbruck. All I can say at the moment is that goiter is not a common disease in the Lebanon. In fact, I can recall having observed only one case of this disease, during my three-years' experience in the country.

This whole question of the relation of deficiencies and diseases to head form needs more extensive investigation.

CONCLUSIONS FROM THIS CHAPTER

The facts of artificial cranial deformation show that the head of the newborn infant is quite plastic, and may be formed one way or the other, to a greater or lesser degree depending on the intensity and duration of the application of force from without; this artificial form may persist into adult life.

Craniological studies indicate that the difference between brachycephaly and dolichocephaly is chiefly in the posterior portion of the skull. This is not inconsistent with the possibility that external pressure is a large factor in the shortening of even other types of heads than the hyperbrachycephalic; and certainly it does not militate against the generalization from the experiment made in Chapter III.

Studies on the problem of brachycephalization leave room for the factor of external mechanical force applied at an early age. Other explanations have not entirely satisfied students of this problem. There are certainly at least some instances in which such forces played a large part in conditioning head form. Various experimental studies seem to indicate

that such forces can produce an effect on a percentage of infants' heads.

General anthropological literature is not of great use in studying this problem, since it is nonexperimental. Such experimental anthropometry as has been done corroborates our thesis.

Embryological and obstetrical literature indicates that, although the fetal head is more or less brachycephalic, the newborn infant is generally mesocephalic. This lengthening of the head about the time of birth is not normally due to factors involved in the process of birth.

Pediatric and growth literature teaches us two important patterns in the early life of the cephalic index: it is extraordinarily affected by some disturbance, which may well be largely the factor of external mechanical forces, during the first year of life; and the head form at the end of the first year is that of the adult, except for a general relative lengthening of the head which reduces the cephalic index by an amount up to two points, rarely much more. Thus, the early form of the head per-

sists, with moderately small changes, which are predictable.

Medical literature proves that various diseases: rickets, and goiter notably, can disturb the cephalic index. Experimental work on

animals has already shown that deficiencies and overdoses of vitamins can affect the head form of these animals. These factors invite future work.

SUMMARY OF CONCLUSIONS FROM THIS STUDY

FROM the comparison of the observations and measurements on the two series, Lebanese and American, of Maronites, I conclude with certainty that in the case of this group the flattening of the posterior portion of the head (no matter what particular form it may take) is caused by the Lebanese custom of cradling the infant. The hyperbrachycephaly of the Lebanese series is due to the same cause.

The interference with natural form occasioned by the cradling custom affects primarily the posterior portion of the brain case.

It would seem that the face is not affected by this process of deformation.

A study of the world-wide distribution of hyperbrachycephaly, and of that of methods of producing changes in the shape of the head (cradling, or the equivalent), gives the general picture of a correlation between the two distributions. This correlation, in view of my experimental results on the Maronites, gives extremely strong probability that the two phenomena are causally related in large areas for which there is good information; there is strong probability that the causal connection is quite general; but it is certain that in every area the factor of infant postnatal treatment must be accurately assessed in making judgments on the cephalic index, or in making use of this index in racial or other physical diagnoses or conclusions. This is true not only when the index is hyperbrachycephalic; since the effects of infant treatment can be small as well as large, depending on circumstances.

These conclusions are strengthened by those reached in other studies. The literature on artificial cranial deformation shows clearly that an unnatural head form imposed on an infant can remain such into adult life. Craniological studies emphasize the difference in the posterior portion of the head when dolichocephalics and brachycephalics are compared. In general, they indicate the greater value of the face as over the brain case for diagnostic criteria. Studies on the problem of brachycephalization suggest the need for the interpolation of the factor of infant treatment into explanations hitherto erected solely within the framework of racial concepts. Prenatal and postnatal studies show that the average uncradled infant is born mesocephalic, but becomes first hyperbrachycephalic during a period when nondrastic infant treatment is most apt to have its effect, and then brachy or meso later on. The head form achieved at the end of the first year of life is retained into adult life, with a lowering of the cephalic index by at most two points. Therefore disturbances in the cephalic index do not have to be as dramatic as those among our infant Lebanese Maronites in order to affect the adult index.

The most general — and monitory — conclusion of this study is that the cultural factor influencing early (and therefore later) head form must be reckoned with in physical studies. After all, no matter how denatured by statistics and geometry, it is still the *human* head we are studying.

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THE MOUNTAINS OF GIANTS
A RACIAL AND CULTURAL STUDY OF THE
NORTH ALBANIAN MOUNTAIN GHEGS



The Typical Mountain Ghag — Malsia e Madhe.

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VOL. XXIII — NO. 3

THE MOUNTAINS OF GIANTS

A RACIAL AND CULTURAL STUDY OF THE
NORTH ALBANIAN MOUNTAIN GHEGS

BY
CARLETON S. COON

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PREFACE

THE data on which this study is based were gathered in northern Albania during the fall, winter, and spring of 1929-30. Funds were provided by the National Research Council of Washington, D. C., and Mr. Francis Drexel Smith of Colorado Springs, Colorado. After the field work was over the National Research Council, whose Fellow I was, paid my salary for one year, as well as the expenses of statistical analysis and typing. On April 7, 1932, the report was presented to the National Research Council, which approved it. It was also submitted to, and approved by, the then Albanian government. Owing to a number of reasons publication was postponed; with the generous help of a grant from the Milton Fund and J. H. Clark Bequest of Harvard University, and of another from the Viking Fund, I was able to employ an assistant in 1946-48 to help me with a complete revision. That revision is now finished.

The personnel of the 1929-30 expedition included, beside myself, Mrs. Stanley Salmen (then Mrs. Coon); Mr. Frederick E. Farnsworth, now a U. S. Foreign Service Officer; Mr. Anthony Stevens, a member of the U. S. Consulate staff at Tirana; and Mr. Stavre Frasheri. We were facilitated in our work by Brigadier General Julius C. Holmes, then chargé-d'affaires at the U. S. Legation in Tirana; the late Dr. J. Dineley Prince, then U. S. Minister to Yugoslavia; Mr. Paul deMille, then U. S. Consul at Tirana, and Mr. Joseph Shutack, a member of his staff. Messrs. Kota, Rauf Fico, and Xhelal Frasheri, of the erstwhile Albanian government, all rendered us aid, as did the British officers in charge of the

Albanian gendarmerie, including General Percy, and Colonels Stirling, Martin, and Glegg. Had it not been for their gendarmes we might not have succeeded.

During the many years which have elapsed since that journey I have received help from many quarters. The venerable Miss M. E. Durham wrote me valuable advice and information. Mrs. Margaret Hasluck, an authority on things Albanian, did the same, and during World War II, I had the pleasure of conferring with her several times in Cairo and drawing on her seemingly limitless fund of information.

The final period of revision was marked by the generous help of a number of Albanian friends in America. Bishop Fan Noli read the first and eighth sections and made many corrections; he also helped with new information. His loyal and able helper, Mr. Gerim Panarity, has always been ready to come to my assistance. In the task of measuring Tosks of two generations in the Boston neighborhood, Mr. Panarity was joined by my old friend Mr. Peter Peterson and his father, Mr. Dmitri Peterson, both of Somerville, Massachusetts, and by many others. Mr. Stavro Skendi of New York gave me information and advice on Albanian linguistics.

David de Harport and Dr. William Laughlin spent many evenings on the measuring program just mentioned. Mrs. Martha Dick did the calculating and typing during the later period, as Mrs. Constance Woodbury did nearly two decades earlier; my wife, Lisa D. Coon, drew the maps and figures. Dr. Stanley Garn helped me understand the mechanics of biting, and Dr. William J. Crozier, as always, gave me statistical advice.

Cambridge, Mass.
June, 1948

CARLETON S. COON

The Officers of the Excavator's Club — a private organization of students of anthropology in Harvard University and Radcliffe College — in order to show their appreciation and affection for Professor Coon, initiated a fund to help defray the publication expenses of this monograph.

The following people contributed:

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THE MOUNTAINS OF GIANTS
A RACIAL AND CULTURAL STUDY OF THE
NORTH ALBANIAN MOUNTAIN GHEGS

THE DINARIC PROBLEM

DENIKER (1852-1918) was the first major taxonomist of man to recognize the difference between 2 types of European brachycephal, the curvoccipital Alpine with his round face, low-bridged blobby nose, and stocky build; and the taller, leaner, Adriatic or Dinaric with his planoccipital skull, his long, triangular face, and his long, narrow, and convex nose.¹ He correctly located the Dinaric concentration in the mountains which skirt the eastern Adriatic coast. A similar form, the Armenoid, he also found in the mountains of Armenia and the Caucasus. Series measured since Deniker's day have confirmed the existence of such people in these areas. Other evidence has shown that Dinaric features are not confined to the white race, but may be seen in parts of Asia and Oceania, and among some of the Indians from Mexico and Peru. These observations have led to the thesis that Dinaricization is a biological process which can happen to people anywhere under circumstances yet to be established.

In all of the early cranial material discovered so far in the world, Dinaric specimens are absent. Nothing could be more removed from the cranial and facial forms of Neanderthal, Cro-Magnon, Galley Hill, or any other known fossils. A short, high head, a long face with a narrow jaw, a flat occiput—all these features stand at the opposite evolutionary pole from the early specimens. None of the early skulls from America are Dinaric, nor are any to be found in the Far East. Neolithic men in Europe, the Near East, and Africa are almost uniformly Mediterranean, and what tendency toward brachycephaly occurs is curvoccipital, presumably a survival from earlier populations.

The earliest Dinarics known consist of a few skulls from Bronze Age sites in Mesopotamia, and late Copper Age burials in Cyprus, dated at about 3000 B.C. Even then, Dinarics were a minority. Fragments of three presumably Dinaric skulls have been unearthed in Spanish

Bell Beaker tombs, while in Britain, Austria, Germany, and the Adriatic Alps a hundred or more may be attributed to the Bronze Age.² Tomb forms and grave furniture indicate without question that these people were immigrants from the eastern Mediterranean. During the whole racial history of Europe there is but one time when these migrations could have taken place—the beginning of the Bronze Age. Even then the immigrants could not have come in large numbers, nor as a racially homogeneous population.

Today the Dinaric concentration lies in the Adriatic Alps, with a smaller nucleus in the Carpathians. Authors who published before 1929 felt that the very center would be found in northern Albania, because the country was wild and rugged, the local speech the most archaic in Europe, and because the small series of mountaineers already measured in Scutari so indicated. Ghegnia seemed the strategic place in which to study the Dinaric problem. This is really 2 problems: (a) to describe in detail the Dinaric type, and (b) to explain it. We shall attempt both.

Modern biology offers at least 2 theories which would explain Dinaricization.

1. *The Hybridization Theory.* A combination of dominants in a cross between 2 genetically different populations, one long headed and narrow faced, the other round headed and broad faced. If the short head, broad head, high head, broad forehead, narrow jaw, long face, long nose, narrow nose—all these were dominant over their opposite numbers, and brought together, a Dinaric form might result.³

2. *The Evolutionary Theory.* As Dobzhansky⁴ points out, most geneticists now hold that mutations take place gene by gene. If Dinaricization is an evolutionary process, then only one gene is involved. To determine this we must study the mechanics of the Dinaric head and face form. Furthermore, if this is true,

¹ Deniker, 1890 and 1900.

² Coon, 1939.

³ This theory was advanced by Hughes, 1938 (still unpublished), and Coon, 1939.

⁴ Dobzhansky, 1944, p. 258.

Dinaric Europeans should not differ from other Europeans, or Dinaric American Indians from other American Indians, etc., in unaffected features, such as skin, hair, and eye color, hair form, hair distribution, etc.

In "The Races of Europe," I pointed out that all over central Europe different populations had been experiencing a steady rise in the cephalic index from about the 6th century A.D. onward. I attributed this to the re-emergence of genetic elements derived from pre-Neolithic populations. As farmers and herdsmen penetrated Europe, the hunters and gatherers withdrew to the forests and mountains. Eventually the latter were assimilated as a socially submerged element in the general population. The historic increase in brachycephaly was thus due to the selective value of that particular head form as their conquerors killed themselves off in war or were selectively reduced by emigration.

Weidenreich has recently taken the position that brachycephalization is a progressive evolutionary step. He claims that it produces a more efficient container for the brain than a long, narrow skull; that a round head is best suited for the requirements of the erect posture.⁵ Whether or not this thesis is mechanically correct, Weidenreich has done a service in lending his support to the manifest conclusion that European brachycephaly is endemic and not of recent derivation from other continents. That in an isolated population it may be dominant is one of our present subjects of investigation.

The present material is suited for such a study. The land of the tribal Ghegs is a small country, little more than 3500 miles square. Its population probably runs to about 250,000, of whom 90,000 may be Catholics and 160,000 Moslems.* In 1930 we were told that the population of Mirdita was about 11,000—all Catholic; that of Puka 14,000, of whom 8000 were Moslems and 6000 Catholics. These figures are

⁵ Weidenreich, 1945.

* Since this monograph was written it has become fashionable in America to employ the more correct form, *Muslim*. It would have been pleasant if this change could have been made here and throughout the text. However, so much time has been spent, and so many corrections have been made, that I beg the readers' indulgence for retaining the *o* and *e* in place

probably too low. The 1927 census reported 814,485 persons in Albania; the 1930 census raised the figure to 1,003,124, of whom 104,184 were Catholics. The 1930 census gives the population density for Albania as 36.5 per square kilometer, or 102 per square mile. The mountain Gheg country, newly divided into 3 provinces without regard to tribal boundaries, was said to have 100 inhabitants per square mile in Dibra province, 75 in Scutari province, and 64 in Kossovo province.

In 1930 the land area of Albania was 10,600 square miles. With a population of 1,003,124 the density was thus 94 per square mile, not 102. If we subtract 8 from each of the other figures, we obtain the following corrections: Dibra—92, Scutari—67, Kossovo—56. This can be checked by means of the Catholic figures. Of the 104,000 Catholics at least 14,000 live in cities, leaving no more than 90,000 on tribal lands. Tribal lands exclusively Catholic cover ca. 1225 square miles; those occupied by Catholics and Moslems together about 440 square miles. Thus 1450 square miles may be considered Catholic country, and with a population of 90,000 this yields 62 persons per square mile, which accords with the corrected census figure. Striking a point between the Dibra and Kossovo figures we obtain about 70 per square mile for Moslem lands, which cover about 2300 square miles. This yields a population of about 160,000. One hundred and sixty plus 90 equals 250. Hence our estimate of a total Gheg population of 250,000.⁶

Our series of nearly 1100 men may represent one per cent of the adult male total, a large sample, compared to other national surveys of equal detail. It was drawn from all tribes and from every part of each tribe. It includes chief elders, gendarmes, farmers, what artisans there are, *hodjas*, and in short a complete cross section of the population, both regionally in most tribes, and in regard to differentiations based on rank and occupation. We did not measure

of *u* and *i*. Actually, Arabic vowels are few, rudimentary, and unindicated in ordinary writing. Semantically, they are of less importance than in Turkish, whence the form *Moslem*, and it was the Turks who converted the seventy per cent of the Albanians who are Muslims. Few of them, I suspect, will object to the book on these grounds.

⁶ Almaga, 1932; *Arbenia*, June 1, 1930, for census figures; *National Catholic Almanac*, 1946, p. 93.

mountain men who had come down to the cities; we went into the mountains and measured them in their homes.

Beside the anthropometric data itself we have taken some trouble to describe and discuss the natural and social environments in which our subjects lived. This material is as essential for our study as the measurements and observations on the men themselves. It not only describes the physico-chemical influences that bear on the growing organisms, but also designates their systems of mating, which are of prime importance to anyone interested in genetic problems. Furthermore, and as we shall see this is also of primary importance, it reveals the culturally controlled mechanical influences which literally "shape our ends"; the techniques of cradling babies while their heads are still plastic, and which the Albanian mountaineers, like other peoples in southeastern Europe and western Asia, employ.

In the following chapters we shall not attempt to cover every detail of Gheg civilization. This is not a work of ethnography, but one of somatology. We are interested in the main outline of the culture as a whole and only in those details that bear specifically on our problem: who are the Ghegs and how did they acquire their present anatomical characteristics?

One further act of definition is necessary: to place our sample on the scale of time. In describing any culture, the ethnographer must

set his scene at some specific point in time. All cultures change, either in complexity or merely in detail, and even those which move the most slowly vary enough in a few years to make this step necessary. Such a specific time locus is called the "ethnographic present."⁷

For the purposes of this study the ethnographic present should be the time between the date at which the majority of our anthropometric subjects were conceived and that at which they had reached adult physical form. Thus both heredity and environment will be given due attention. The 1063 men in our series ranged from 18 years of age to senility, with the great majority between 25 and 49. The mean was 39.4 years. We did our measuring in 1929-30. The mean date of birth was thus 1890, with a range of from 1860 or earlier to 1911. If we add 20 years for the maturation process the range rises from about 1880 to the date of measuring, with its mean at 1910.

Our ethnographic present is therefore a time band 2 decades wide, concentrated in the period 1890-1910. At this time the mountain tribal areas of Ghegania formed, like the rest of Albania, part of the Turkish Empire, and the heroic age of family feuds and intertribal warfare was in full swing. In the cultural descriptions given in chapter 3 on "Technology and Occupation" through 6, "Ritual Life," the reader must remember that unless otherwise specified we have reference only to this epic age.

⁷ Chapple and Coon, 1942, front end paper.

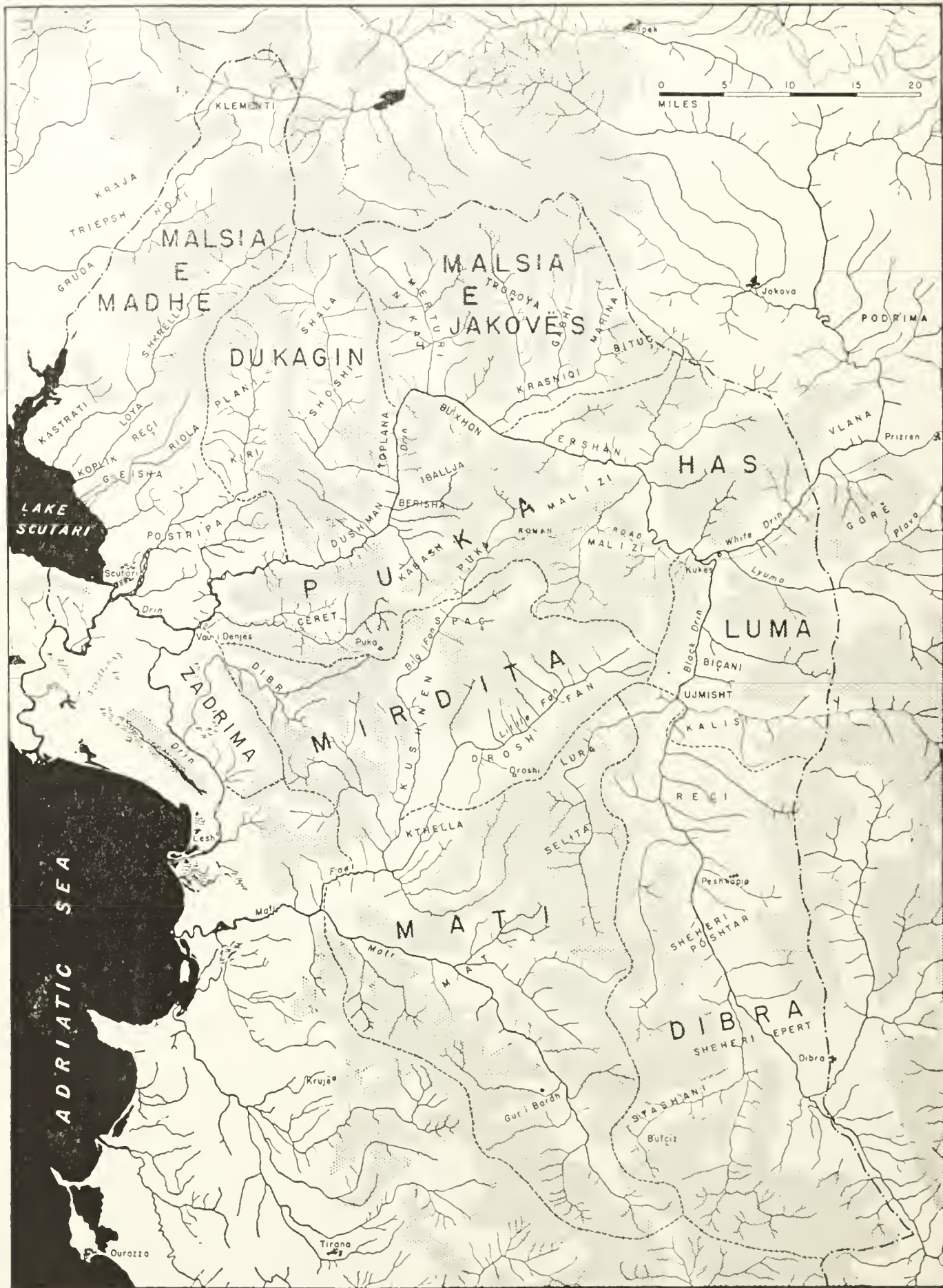


FIG. 1. Northern Albania—the tribal area. (Stippled area symbolizes mountain and forest, unoccupied except as seasonal pasture and source of timber.) Scale, 1: 250,000.

LAND OF THE HIGHLAND GHEGS

THE people who form the object of this study are the mountaineers who inhabit the Dinaric mountain chain on either side of the gorge cut by the river Drin on its way from the Serbian plain to the Adriatic. Most of their country lies inside the political boundaries of Albania, but parts of it have belonged to Yugoslavia for the past third of a century. They speak the northern of the 2 Albanian languages, or dialects,¹ Gheg. They are not, however, the only Gheg speakers. There are Lowland as well as Highland Ghegs. The present study concerns only the latter. The reason why they were specially chosen is that they still preserved, in 1929, a full tribal system of social organization, something very rare in Europe. This has one critical advantage: rules of preferential mating are definite, and are still observed. We know not only who marries whom, but we may also be sure that the same system has been going on for many generations. For a study of human genetics this material has obvious advantages.

The Highland Ghegs who form the object of our investigation belonged to 10 tribes, shown on figure 1. These are Malsia e Madhe, Dukagin, Malsia e Jakovës, Has, Luma, Puka, Mirdita, Zadrima, Mati, and Dibra. Before 1913 all of the tribes, except Dukagin, which now touch Yugoslavia extended a certain distance into the present territory of that country. On parts of the northern border the overlap is an old one. Many of the Montenegrin gentes admit descent from Albanian families, and one finds every stage of linguistic and cultural assimilation between the 2 ethnic units. Just north of Scutari, however, several fully Albanian villages were handed over to Serbia after the Balkan War, and this caused both economic and political distress. Farther east, from Peia to Dibra, the boundary commission which laid out the border between the 2 countries at that time gave the Yugoslavs all of the strategic positions, and all of the market

towns along the Serbo-Albanian border which served as an economic outlet for both peoples.

This ethnic border is far from clear-cut. Several whole tribes of Ghegs live on the Kossovo plain, along with villages of Serbs. The ancestors of these Lowland Ghegs migrated there in the time of the Turks, after the defeat of the Tzar Dushan. These displaced Ghegs are probably descended from the highland tribes, but it would take much work to establish their exact relationships. We were unable to measure more than a few of them, and therefore shall not consider them in this study.

The Lowland Ghegs of Albania, who equally eluded our calipers, occupy the country from the tribal regions eastward to the Adriatic and southward to the river Shkumbi, the traditional frontier between Ghegria and Toskeria. Many of the Tosks are Greek Orthodox Christians. The Ghegs who are Christians are Roman Catholics. The majority of both divisions is Moslem. The most solidly Moslem part of Albania is the central region, in both Ghegria and Toskeria, where the landscape is the least rugged. Both brands of Christianity lived through the Turkish regime most successfully in the mountains. In the south, beside the Tosks, are thousands of Vlachs—shepherds speaking Rumanian as their native tongue—and Bulgars. The Epirote borderland cuts through an area where Greek and Albanian villages overlap, causing trouble.

Throughout Albania one finds camps of nomadic gypsies, living by their traditional trades of metal-working, fortune-telling, horse-trading, etc. In the larger cities there is always a gypsy quarter, whose inhabitants also serve as musicians and prostitutes. In the Gheg country, however, there is no room for gypsy camps or quarters, and the only gypsies which I saw or heard of there were a single individual in Bicaj, and another in Kukës, both in the tribe of Luma.

¹ Gheg and Tosk in extreme dialectic forms are mutually incomprehensible. It would be hard to state definitely whether they are closely related languages or dialects of one language. Each has numerous local

subdivisions. The official language of Albania is based on the southern Gheg dialect spoken in the city of Elbasan.

The country of the Highland Ghegs is entirely mountainous. Although on the map its length is 75 miles and its width 55, these dimensions fail to convey the vertical distance. The trails go up and down and all around, climbing, twisting, and turning. In 1929 it took as long to go the length of the Gheg highlands by available means of travel as it did to cross the United States by rail. To an Albanian, Shala is as far from Dibra as, to an American, San Francisco is from Boston.

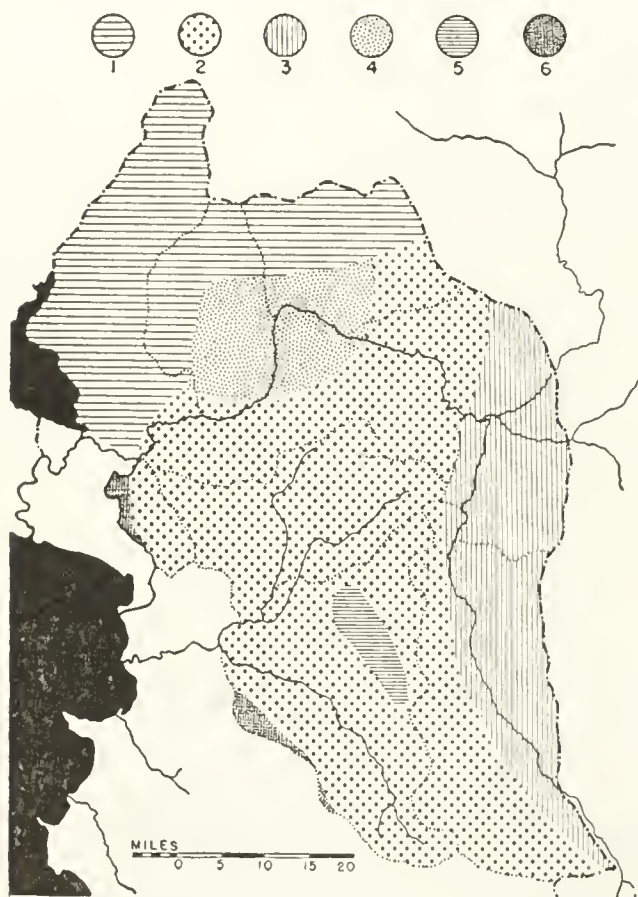


FIG. 2. Three main geological regions in Ghegania. 1—Mesozoic limestone; 2—Serpentine highland; 3—Metamorphosed Triassic and Upper Palaeozoic rocks; 4—Intense folding (Mesozoic-Eocene); 5—Tertiary basin; 6—Eocene flysch. (Almagià, 1932, pp. 464-73, map on p. 467, "after Nowack.")

A concentrated jumble of snow-covered peaks, rising to 7000- and 8000-foot heights, the mountains of Ghegania follow no simple system of parallel ranges and valleys, but instead form a knot through which the river Drin has cut a passage in its tumultuous journey from the plain of Kossovo to the Adriatic Sea. In the walls of the Drin gorge the travel-

er can see an impressive record of geological change—layer after layer of sedimentary rocks, twisted and upheaved like a slice of marble cake.

Although the systematic geology of this entire region remains to be studied, enough is known of it for our immediate purpose. Figure 2 shows 3 main geological regions in Ghegania. The first is the Mesozoic limestone mountains of Malsia e Madhe and parts of Dukagin and Malsia e Jakovës. This is a continuation of the bare rocky landscape so characteristic of Montenegro, which, north of Lake Scutari, reaches the sea in a succession of drowned valleys, the greatest of which is the Gulf of Kotor. Here the topsoil is thin, while alluvium is almost lacking in the stream beds. No trees crown the slopes, white in summer and winter alike from the alternate exposure of lime and snow. In the bend of the Drin the smaller area of intense folding is likewise mostly limestone, covering part of Dukagin, the Nikaj and Merturi sections of Malsia e Jakovës, and the Buxhon and Berisha *bairaks* (see p. 30) of Puka. In the country so far designated, most of which is north of the Drin, geological conditions resemble those found immediately north of the border.

The second zone is one of igneous rocks, composed mainly of serpentine and gabbro. This zone covers all of Mirdita, most of Zadrina, Mati, Puka, and Has, and parts of Dibra and Malsia e Jakovës. In this region limestone is so scarce that few people can afford to build stone houses, owing to the lack of mortar. From the dietary standpoint one must understand the importance of this contrast between the northern geological zone, where the water is permeated with lime, and the central, where it is lime-free. This takes on significance because all foods consumed are locally raised—the fodder, the grains, the milk, and the meat.

The third region is the eastern zone, including half of Has, all of Luma, and the greater part of Puka. This is composed of metamorphic Triassic and Upper Palaeozoic deposits, deeply eroded, with steep slopes and rich alluvial bottoms. From the dietary standpoint, it lies intermediate between the northern and the central regions.

Through these mountain masses, composed of different kinds of rocks laid down and up-

heaved at different periods, flow its 2 rivers and their tributaries. These are the Drin and the Mati. By studying them one can arrive most readily at a knowledge of the tribal geography of Ghegnia.

East of Kukës there are 2 Drins, White and Black. The White Drin carries off the water from the eastward slope of the Peia or Pesh region in Montenegro, then flows southward to the Albanian border, where it turns west. A short but swift confluent flows westward under the bridges and flourmills of the city of Prizren. The Black Drin is the outlet for Lake Ochrida, south of Gheg territory. It flows northward in a nearly straight line through the Dibra valley, past the towns of Big Dibra and Little Dibra (Peshkopia). As it flows northward the valley grows narrow, and in places becomes a gorge, which opens out again before the river reaches Kukës.

At Kukës the 2 branches meet. From this point on, the slope of the river bed is great, and the water rushes down, foaming and leaping, through its canyon-like channel until it reaches the lowlands, where it divides into 2 channels. One flows into Lake Scutari, which in turn empties into the sea. The other goes directly into the Adriatic. Except for the last few miles of its passage, the Drin is too swift for navigation. Its possibilities for hydro-electric power are great.

The other river, the Mati, flows into the sea a short distance south of Lesh. It drains the tribal lands of Mati, and most of Mirdita. It too is swift and unnavigable, and in winter and spring often impossible to ford.

These rivers and their watersheds form the usual boundaries between tribes. Dibra and Mati form the drainages of the Black Drin and Mati rivers, respectively; and the watershed between these rivers is their boundary. The White Drin, in Yugoslavia, is the boundary between Has and the lowland tribe of Po-drina; in both countries it divides Has from Luma; and in Albania alone, the combined Drin divides Has from Puka, Malsia e Jakovës from Puka, Dukagin from Puka, and Malsia e Madhe from Puka and Zadrina. The northern branch of the Mati, the Fan, which is in turn divided into the Little Fan and the Big Fan,

drains Mirdita, except for the *bairak* of Spaç, the northwestern finger of which forms part of the Drin system. With this same exception, the watershed between the Drin and the 2 Fans is the boundary between Puka and Mirdita. The continuation of the watershed between Mati and Dibra again separates, farther north, Mirdita from Luma. Mati and Mirdita, and Dibra and Luma east of the Black Drin, are parted by deep valleys, running laterally, cut on opposite sides of the river.

These rivers serve more often as tribal boundaries than as routes of travel. Their banks are so steep that the roads usually follow the crests and shoulders of the mountains, only dipping down into the valleys where it is necessary to cross them. Their waters are so swift that only in rare spots can they be navigated. All in all, they are barriers to travel and communication.

It is a rule long known to geographers that in the Mediterranean basin, lands lying on the western slopes of peripheral land masses receive more rain than those on the east.² The higher the mountains flanking the coast, the more the rain. Ghegnia and Montenegro have the heaviest rainfall of any Mediterranean countries. The Adriatic coast, from Lesh up to Dubrovnik, receives well over 60 inches of rain a year; and all of Ghegnia, back from the coast, gets between 60 and 40 inches, with the total decreasing to the east.

This is not all winter rain. It may rain any month of the year, and the summer rainfall totals anywhere from 4 to 8 inches, enough to permit the cultivation of maize by dry farming. This fact alone takes the Gheg highlands out of the Mediterranean climate area. The winter rain, which begins to fall in September, becomes snow at the higher altitudes. Only in the highest valleys and on the peaks does it last out the winter. Elsewhere a succession of snowfalls and thaws renders this region as unpleasant as New England in early spring.

The temperature again prohibits the growth of many Mediterranean crops, such as the fig and olive, which soon disappear as one leaves the coast. All of the uplands receive severe winter frosts, and on the border of the Kos-ovo plain the climate becomes continental.

² Semple, 1931, chap. 5.

The natural vegetation of the Gheg highlands has been preserved more completely than that of almost any other Mediterranean border country, thanks to the difficulty of travel and transportation. North of the Drin in the limestone area, the landscape is mostly bare, since the soil is too thin to support a forest. The igneous zone, however, is heavily forested, with oak succeeded by groves of enormous beech trees, some reaching 10 feet in diameter. At one point on the road between Puka and Kukës the road passes through such a forest, where the traveler used to see woodsmen hewing monoxylic table tops, for sale in Scutari, out of these giant trunks. Up beyond the level of beeches one meets pine, and these trees too are of great size, comparable to the forest, on similar soil, in the middle of Corsica.

While the peaks of Shala are forever white, those of Mal i Zi, the Black Mountain, to the south are forever dark with the coniferous cover. Only in a few places south of the Drin do the peaks emerge above the tree line. Over in the metamorphosed zone to the east one finds more beech and pine, and other broad-leaf species such as elms and plane trees, while cypresses have been planted in Moslem cemeteries and mosque areas.

As might be expected the mountains and forests of this little-developed country still harbor a number of dangerous wild animals. The lion of Homeric times is gone, but the bear, the wolf, and the wild boar remain. Deer graze on the high mountain slopes, and in the forests, but the Ghegs will not kill them. The only wild animals of any economic importance are the various members of the weasel family, particularly martens, which a number of mountaineers trap for fur. Otherwise the fauna is a nuisance, since bears and wolves will steal sheep and kill cattle, and flocks need constant guarding by one or more men with rifles and a number of ferocious dogs.

It is in this environment, which must have changed but little since Roman and even earlier times, that the tribal Ghegs have survived until the present day, retaining a language and customs which carry them back to the Iron Age. The land forms, the climate, the geographical position away from main routes of travel and migration, all combine to make the mountains and forests of Ghegria one of the most marginal and isolated regions of Europe. It is a true refuge area, comparable to the Caucasus and the western Himalayan reaches, the Appalachians, and the Ozarks.

TECHNOLOGY AND OCCUPATION: THE ECONOMICS OF AN ISOLATED SOCIETY

HABERLANDT, Baron Nopcsa, and others have written learnedly and in detail about the material culture of the Gheg mountaineers.¹ It is not my intention to duplicate their work. What I have to say about technology in this place is written for one purpose only, to elucidate the problem of human genetics in northern Albania. First of all, we shall examine the anthropometric series itself, since that is the source of our information on the Gheg phenotype (fig. 12). The measurement blanks contain, besides the anthropometric and observational constants, the following information for each subject: serial number, sex, date, place measured, age, tribe, *bairak*, father's group, mother's group, number of wives belonging to father, number of children of each sex per wife, occupation, office or rank, religion, kinship with other members of series, and photographic reel and frame number.

We measured 1102 persons. Of these, 1058 were tribesmen both of whose parents had come from the same tribe as the subject. Eleven resulted from intertribal marriages. Thirty-three others remain to be accounted for. Nine were sons of Has fathers and Podrima mothers, 4 were Podrima men. These 13 were living in Has tribal territory, on the Yugoslav side of the border. Podrima is one of the Albanian tribes situated on the plain of Kossovo, wholly in Yugoslav territory. No

intermarriages were recorded between Podrima people and Has tribesmen from the Albanian side of the border.

The 20 others were outsiders in Albanian-controlled Gheg tribal territory. Sixteen came from the large market town of Big Dibra (Dibra e Madhe to the Albanians, Debar to the Serbs) in Yugoslavia, which contains a mixed population of Albanians, Serbs, and a few Turks. One was a Serbian-speaking Moslem from the alien *bairak* of Gorë which forms part of the tribe of Luma; his home lay also beyond the border. Another was an Albanian from the town of Jakova. Two others came from inside Ghegnia but outside the tribal territory—from Krujë and Elbasan, respectively.

These 20 men were all first-generation immigrants. There was no older generation like them. I measured none of their sons, and thus this particular immigration had had no effect on our series. All of them were specialists in some kind of technology. Through the study of the data on occupations given in our tabulations we can discover the exact situation of these people.

In our series of 1102 men, 36 occupations were listed. These may be grouped into 7 classes: extractive, processing, services, transport, trade, political, and religious. Their distribution among the 10 tribes and 44 "others" is as follows:

	TOTAL	EXTR.	PROC.	SERV.	TRANS.	TRADE	POL.	REL.
McM	105	101		1		2	1	
Duk	106	103					3	
MeJ	104	87		2	1	7	7	
Has	114	102	11					1
Lum	109	79		1		2	25	2
Puk	102	87		3		1	11	
Mir	101	89	4	1		1	6	
Zad	105	104					1	
Mat	104	80	2	2			20	
Dib	108	75	7		3	11	9	3
Others	44	23	7	2		7	4	1
	1102	930	31	12	4	31	87	7

¹ Haberlandt, 1917; Nopcsa, 1925; Start, 1939; Traeger, 1904.

Extractive: Of the 930 men so listed, 926 were farmers, 3 shepherds, one a woodcutter. The woodcutter and one shepherd came from Luma, the other shepherd from Mirdita. Eighty-five per cent of all inhabitants of Ghegnia measured are farmers, 88 per cent of all tribesmen.

Processing: Twelve occupations are listed under processing: charcoal burner, blacksmith, tinsmith, carpenter, saddler, hatter, tailor, shoemaker, butcher, baker, cook, and pastry cook.

The 2 charcoal burners, the smith, and the carpenter were Mirdites. Their occupations are mutually dependent. As a rule iron goods are imported, and distributed by merchants in the towns. Axe heads, sickles, billhooks, and other tools of familiar Iron Age shapes are produced by craftsmen in the larger centers, such as Scutari, for the mountain trade. Minor metallurgy is usually carried on by gypsies.

The other specialists fall into a different class. None were mountain men, except one cook and one baker, both natives of Mati, who worked in the new prefecture headquarters established at Bureli, within Mati territory, by King Zog. They were there because of the impact of the new central government on the mountain tribes. Neither of these men had long been professionals.

The tinsmith, the saddler, and the hatter were natives of Peshkopia, the principal town of Dibra. Of the 3 tailors in this town, one was a native, one had come from Big Dibra, and the third from Jakova. The butcher, one of the 2 bakers, and the cook measured in Peshkopia were Big Dibra men. The pastry cook worked in Kukës, in Luma. This leaves 11 bakers. These men all came from Gonaj and neighboring villages in Has, within walking distance of Prizren. Baking is their traditional hereditary occupation. They get their flour from the gristmills of Prizren and sell their bread in that city. Many of these Hasi bakers migrate to distant cities to work. Mr. Anthony Stevens, our guide, and an employee of the U. S. State Department, began life as one of these bakers; as a boy he went to Cincinnati to work in a bakery.

It can be seen that within Gheg tribal territory processing techniques are practised almost exclusively in the eastern borderlands.

Peshkopia has grown rapidly because the international boundary commission of 1913 cut off the Dibra mountaineers from their natural market town of Big Dibra. Hence many of the Big Dibra men moved to Peshkopia, which is just inside Albania. In the same way Prizren was cut off from the Luma people, who built up Kukës; Jakova from the Malsia e Jakovës men, who also go to Kukës. On the western side no such disturbance has taken place. Scutari, Lesh, and Kruja now, as for centuries past, serve as market towns for the mountain people.

Services: Only 12 men are listed under "services." Two of these are innkeepers. One is a Puka man, host at Rrap, his native place. The other is an outsider, a Kruja man, whose inn is at Gur i Bardh in Mati. Kruja men specialize in innkeeping, and in the heyday of Ottoman power might be found all over the Turkish Empire, including Asia Minor. These *hanjis* marry in Kruja, and do not mix with the populations in the regions in which they do their business.

Three men were restaurant-keepers: one Koplik man, whose shop was presumably in Scutari, a Luma man, and a Malsia e Jakovës man, with shops in Kukës. The barber was a Malsia e Jakovës man, working in Kukës. Of the 2 waiters, one was a local man serving the gendarmes in their post at Puka, the other a Big Dibra man working in the hotel in Peshkopia, a new institution. Of the 3 listed as servants, all were local. One served the prefect and another the teacher in the new government center in Bureli. The third worked for a priest in Mirdita.

Of the 12 "services" listings, 9 can be accounted for as a result of recent political events.

Transport: Transportation in Ghegnia in 1929 meant but one thing—the services of *kiragis*, those incredibly tough horse-drivers who would take you and your goods anywhere, and try to raise the price on the road, once you were at their mercy. Three out of 4 came from Dibra, and one from Malsia e Jakovës. As far as I know, all *kiragis*, like all *hanjis*, are Moslems.

Trade: All merchants in the mountain country are shopkeepers; there are no large or complex commercial institutions. Of the 31 shop-

keepers measured, 18 were in Peshkopia. Of these, 11 were locals, and 7 Big Dibra immigrants. Six shopkeepers were measured in Kukës, all Malsia e Jakovës men; 2 in Bicaj, a Luma village, were local. One Malsia e Jakovës man was measured in his own shop in Kolgecs, a local town. Thus 25 out of the 31 shopkeepers came from the eastern borderlands, from big towns or their neighborhood. The situation is the same as with the craftsmen whose goods they sell.

Four shopkeepers remain: 2 are from Malsia e Madhe, one with his shop in Scutari, the other at home. Of the other 2, one is a local in Puka, the other a local in Mirdita. The Mirdita man, who has the only shop in that tribe, claimed that his father was an Austrian officer who begat him during World War I. This would give him a maximum possible age of 14 years at the time of measuring. He was at least 30.

TECHNOLOGY, A REVIEW

From the foregoing study of the non-somatological data collected in our series, and from what is generally known of the material culture of the Ghegs, we can make a brief summary, keeping in mind always our main purpose, to define the economic elements in the cultural situation within which the Ghegs live.

Cutting tools are of iron. They are made by blacksmiths in the market towns in which the Ghegs do their trading. In Scutari, for example, there is a whole quarter devoted to smiths, most if not all of whom are gypsies. With hammer and tongs, a small anvil, and a pair of foot-pump bellows they forge nearly all of the metal objects needed by the mountaineers in their farming, herding, transport, and household carpentry. They make small anvils, hammers, nails, axes, adzes, knives, ploughshares, shovels, hoes, toothed sickles, billhooks, beam ties, door hinges, horseshoes, horse hobbles, chains, bits, firetongs, andirons, tripods, lighting racks, and probably other articles which have escaped our attention.²

There is no smelting in the neighborhood of Ghegnia. The iron which the smiths use is all imported. Although city blacksmiths can

make all of these implements out of trade iron, it is unlikely that the rural smiths, like the one measured in Mirdita, do much more than horseshoeing. No one in Albania can make steel implements. Not only the material, but the finished implements themselves, must be imported, and hence they are expensive. That is why saws and augers are scarce in the mountains, where almost the only steel tools seen are files, useful for sharpening iron tools and for woodworking.

This explains the primitive nature of Gheg woodworking. Most wooden objects which require special tools or skills are bought in the market towns. Here 3 kinds of woodworking specialists carry on their crafts: the coopers, turners, and joiners. The coopers make tubs and buckets for kitchen use, including churns, butter firkins, and casks for storing grain. The material of which these are made is pear wood. The turner cuts out on his lathe various parts for looms, to be set up later; bobbins, spools, reelers, winders, and spool frames. The joiners provide the mountaineers with solid, ornately decorated chests of pine wood, as well as cradles in which to carry their babies, of which more later.

The Gheg at home in his mountains is a jack-of-all-trades. He may not be able to manufacture the special objects listed above, but he can adze out beams for his house, put together a new plough during the winter months when there is little work out of doors, or build one of his massive chairs. Professional carpenters are rare, although some men may show more skill in this than others.

In Ghegnia, as in most of the primitive world known to anthropologists, it is the custom not to let fires go out, for it is hard to start a new one. Sometimes a householder will walk several miles to borrow a glowing coal from a neighbor. In 1929 and 1930 most of the Ghegs were making fire with flint and steel or with old-fashioned dry-wick lighters. They did this slyly, and in my presence only when they could not borrow a match from me. King Zog had sold the match monopoly to the Swedish match trust, which had promptly set a price of 5 cents a box on penny matches. The king had at the same time prohibited the use of flint

² Haberlandt's, Nopcea's, and mine. The best account of this is to be found in Haberlandt, 1917, p. 90.

and steel or lighters. This left the mountaineers in an unenviable position—they could not afford matches nor legally start fires by other means. Outside the market towns, however, their illegal actions passed unnoticed.

Several authorities, particularly Nopcsa, have concerned themselves with north Albanian house types. These are usually divided, on the basis of ground plan, room arrangement, and architecture into a number of classes: simple one-roomed huts, usually employed in the summer only by shepherds on high mountain pastures; 2-roomed, one-storied houses, with one room for animals and the other for the family; the so-called veranda houses, with a wooden front porch and columns, reminiscent of the Homeric hall; and finally the *kulla* or defensible stronghold (fig. 8, a).

The 2-roomed house seems to be basic in the mountains, although historically the more complicated structures have made these edifices rare. The veranda house, although old in the Mediterranean, was apparently late to reach this refuge area, being spread with Islam. The *kulla*, or stronghold, is said to have come at the same time as the veranda house. Both reached Kastrati and Shala about 1850, being introduced by one man who had lived in Istanbul, Liho Čuni.

For building materials the Ghegs are strictly limited to local supplies, since transportation is so difficult. In the region designated on figure 2 as "serpentine highland," the stone is hard to cut, and unsuited for fine masonry except in the hands of experts. Furthermore, lime is found in few places only, and it is usually impossible to make mortar without many tedious trips with pack-horses or donkeys. In this region many of the houses are made of wood, with squared logs laid on each other and held in place by vertical or diagonal crosspieces. Others are made of wattle: vertical poles side by side, with flexible wands woven in and out between them. At times this wattling is bare, but usually it is covered with some sort of plaster or mud.

Where there is plenty of suitable stone and lime, these materials are used. The simpler, poorer houses are of dry masonry, but the majority are built with mortar. Roofing material varies from thatch to shakes, slate, and tile. Years ago thatch was much more com-

monly used than at present. The shift from wheat to maize as staple cereal deprived the farmers in many parts of Albania of roofing material.

The interiors of most houses are quite bare, with no carpets on the hewn plank floors, and little decoration on the walls. In the older houses a fireplace covers about 10 square feet of floor area, and the smoke finds its way out through the thatch or roof tiles. In so doing, it cures meats hung in a rack above the fire, particularly in Catholic houses where pork is preserved for the winter.

The introduction of the *kulla* brought with it some drastic architectural innovations. The *kulla* is a 3-storied square tower, built with one purpose in mind—defense. Nopcsa finds a high correlation between the incidence of *kullas* in different villages and *bairaks*, and that of death by violence. The lower floor of the *kulla* is for the shelter of animals. The second and third are for habitation. One door opens into the stable below, a second, up a flight of bare steps, to the living quarters.

With a multi-storied structure something had to be done about smoke. Hence fireplaces were built one above the other, and a high chimney ensured draft. One of the principal troubles with the old-fashioned house was its lack of a toilet. The feuding Gheg, attending the needs of nature in a corn field of a frosty morning, made an excellent target to his enemies hiding in ambush, and the feudal code contained no sporting rules to outlaw this easy shot. The *kulla*-builders therefore constructed an overhanging enclosed balcony of masonry, to serve as "W. C." In the conflict between sanitation and safety, safety won. The drain hole is made crooked to prevent pot shots from below. Since there are few windows, and these are built more for gunplay than for light or ventilation, a strong draft usually rushes up the drain hole. Down below in a heap against the wall the refuse accumulates, and were it not for the healthy mountain climate and the hardihood of the mountaineers, epidemics would be commoner than they are.

Gheg houses have both a social and an economic implication. They are usually large, and accommodate an extended family and its animals. Serving for defense, they reflect the

local independence of the families within them. In the *kullas*, women are placed on the second floor, men on top; or else the women will live in a nearby unfortified house, while the men take refuge in the *kulla*. This reflects the inviolability of women in the local feuding law.

Kulla-building requires the skill of professionals. All stones are squared, and carefully set in mortar. The fireplaces and chimneys must be properly aligned and made to draw. The great height of the walls requires scaffolding. Nopcsa³ says that they are built by itinerant masons, and that in 1908 they cost between 440 and 660 crowns (110–165 dollars). I was told several times when I asked that the *kullas* were built by masons from Dibra,⁴ who also build them in Montenegro, Bosnia, and elsewhere in Yugoslavia. Exactly where in Dibra these masons come from I do not know. I have never seen one at work, nor did any appear in our series.

These houses, of whatever type, are heated by wood, which at the same time cooks the meals. In most of the region there is plenty of firewood, but in the northern limestone region it is scarce and must be sought afar. The mountaineers earn a little spare cash by carrying loads of firewood down to the market towns to sell.

In many houses in 1929 a primitive form of illumination was still employed. When it grew dark the host would lay a number of pine splinters in several iron racks, hanging from the roof, and light them. The oil in the wood would provide enough light to see by, but hardly enough for reading. In other houses, however, they used candles, and in still others oil lamps. Kerosene has been packed into this country in square 5-gallon tins for some time, and the tins themselves are as much sought after as their contents.

Gheg clothing has received even more attention than their housing. The costumes are picturesque, and make fine collections. They vary from tribe to tribe, *bairak* to *bairak*, and in some cases between villages. After six months of travel over the mountains I was able to tell where a man came from in many cases by the cut of his jacket, the color of his

trousers, the shape of his cap, and particularly by the design on his stockings. If after 6 months a foreigner had reached this threshold of discrimination, a native mountaineer with good eyesight could identify a stranger as far as he could see him, just as easily as a modern boy can tell the make of a car or airplane at a glance. This habit of wearing one's insignia so conspicuously has a very definite meaning. The man is proud of his family and native place, and defiant. His desire to be identified is greater than his fear of death. He does not go far from home unless his mission is a serious one.

The man's costume starts with a brimless felt cap (*frontispiece*), either conical or flat on top; often he wears a kerchief around it like a thin turban, or neckcloth. The upper part of his body is covered with a woolen jacket, with sleeves and some kind of collar, often sailor-fashion. As a rule he is shirtless. From waist to ankle he wears a pair of woolen breeches, usually skin-tight on the legs, and with a slight fullness in the seat in some regions which reflects the influence of the Turkish baggy pants. He goes without underdrawers. If wealthy, he may also wear an ornate sleeveless waistcoat. He usually sports some kind of wide cummerbund, or belt. His feet are shod in opingas, or rawhide buskins, the common primitive European footgear found not only in the Balkans but in Russia, Ireland, and other places where tradition is strong enough and shoes expensive enough to preserve this ancient homemade shoe type. In 1929 the poorer Ghegs were wearing pieces of automobile tire in place of opingas, and it gave one a start to see a fresh section of Goodyear or Michelin track on a mountain path 18 inches wide. At the same time the wealthier were wearing western manufactured shoes.

Both men and women wear stockings, knit by the women, which bear the family design as clearly as a Scottish tartan. I have seen many men, however, who had none. The women's dress varies from place to place, but is basically a combination of a full bell-like skirt, reminding one of a Cretan goddess's lower garment, surmounted by a full blouse or bodice. Add to that a headcloth or shawl, and much jewelry.

³ Nopcsa, 1925, p. 62.

⁴ This is confirmed by Bishop Fan Noli.

which is bought from silversmiths in the town, and the woman is clothed.

These costumes are undoubtedly ancient. Some of their elements may be traced back to the early Mediterranean, others to the central European Iron Age. However, the Ghegs themselves do not make all parts of them, but carry on the tradition by demand, like the Crow Indians for whom Stetson has, for decades, been manufacturing a special kind of hat.

The basic cloth is woven at home. The farmer gives his wife the necessary wool from his sheep, both white and black. She cards it with a homemade device, either a flick bow or a nail-studded card, and spins it. Her spinning kit consists of a distaff, a spindle, and a basket. Holding the distaff in one hand, she twists the wool with the other, and winds it onto the spindle in the basket. Whenever she has nothing else to do, or when she is walking along the trail, the Albanian housewife dutifully spins, and her spinning has soon become a reflex action, like knitting or bead-telling.

When she has enough wool, she begins weaving. The Albanian loom is an ordinary European 2-beam affair, similar to those used in the Hebrides and the Kentucky mountains. It has a wooden frame, 2 beams or rollers between which the warps are stretched, a wooden batten, and a foot-operated heddle. The bobbin, within its shuttle, is hand-thrown. The men buy all of the delicate parts of this loom in the town, from turners. The rest of it they make at home. The loom is kept mounted only while a length of cloth is being woven. When not in use the loom is taken apart and piled in a corner with other household impedimenta.

Once the cloth has been woven, it must, if intended for masculine use, be fulled. This involves keeping it wet, working it about, and pounding it for several hours. The mountaineers employ an ingenious water-powered device for this purpose. Several writers have observed these mills; Nopcsa has drawn one.⁵ I saw several. The fulling mill consists of an open-air wooden structure powered by an overshot water wheel. A smaller stream of water runs through a trough to wet the cloth. The wheelshaft is studded with four wooden

lugs or cogs, which lift up a heavy wooden hammer and let it drop, 4 times for each revolution. Two staggered sets of cogs and 2 hammers give the cloth a constant pounding as long as it is left there.

No one seems to know who invented these mills or who makes them. When you encounter them along a stream, they are usually unattended. Apparently the wife, having woven her cloth, turns it over to her husband, who takes it to the mill to be fulled. There is no professional fuller, and each mill seems to belong to the group of kinsmen or neighbors who use it.

The women make their own clothing, for the most part of unfulled cloth. They also crochet the stockings, and stitch the opingas, worn by both sexes. The men, however, carry the fulled and heavily felted cloth to the market town, to a tailor who then cuts it in the traditional design of his client's native place, and sews up the pieces and embroiders the finished garment.

A number of other specialists are involved in the production of men's clothing and equipment. A special craftsman provides the quantities of braid with which jacket and trousers are adorned. Hatters, equipped with wooden molds to suit every variation of tribal taste, shape the felt caps, conical or truncated, white or black, which all mountaineers wear. Leather-workers, who are traditionally Turks, make ornate belts for the men, as well as saddles, bags, and straps. Special shoemakers make footgear for those who can afford it, although most wear the opingas which their wives produce from local hides. Most of the shoemakers are Kruja men, and this is a Kruja specialty. At Kukës we saw zebra hides on display outside several shops. These had been sent all the way from South Africa for the manufacture of opingas.

As previously stated, wooden buckets are made by professional coopers in towns, and purchased by the mountain people, who use them in dairying and for food storage. Baskets, however, are local products; the country people often bring them to town for sale. Several villages near Scutari specialize in basket-making, and the women, who weave

⁵ Nopcsa, 1925, p. 134, fig. 99.

them, bring them to market along with embroidery. These include not only spinning baskets and hand-carrying baskets, but also large osier panniers used in transport—a man can carry one on his back, a horse, two. I believe that the panniers are made by men.

Other containers include copperwork and pottery. The coppersmiths in each town hammer out sheets of metal into round trays, which can be used for baking cheese dishes, pastry, etc., or for tea and coffee service. They also make kettles, water jugs, and wash-basins. All of these things are purchased by the mountaineers, who now and then acquire a European chamber-pot to use as soup tureen, and a set of glass tumblers.

Three kinds of pottery find their way into the mountaineer's household. In the Catholic tribes, if not elsewhere, the women still make an Iron Age vessel, of simple profile, with handles, without slip, and decorated by incisions. It is hand-modeled, and fired in such a way as to give it a black surface. In the towns, professional male potters make a porous ware on the wheel. This is used for carrying and storing water. Regular modern glazed pottery is imported from Italy, and subsequently sold in the bazaars.

Food preservation and storage techniques vary between Catholics and Moslems, owing to their differences in diet. The Catholics preserve much pork by salting and smoking. The men of each household will butcher as many fat pigs as the family needs or can spare, in the fall. They cut the belly fat into flitches and hang it over the fire. An especial delicacy is the *peshk*, or "fish," a long strip of lean back-bacon, smoke-cured, which they cut in slices and fry. Besides these whole pork pieces, they make sausages and cure them in the same way. The Moslems as a rule eat only fresh meat and live on mutton, whereas Catholics eat both mutton and pork.

Both store their cereals and legumes in tubs and bags in the house, and keep maize in special outdoor cornercribs, elevated to protect them from rats. Very often a fierce dog will be seen and heard, chained under the crib. Both make butter from their cows' milk, and cheese from that of sheep and goats, although the use of the latter is much more common among the Moslems. Catholics, in country fit

for grape-growing, make a potent red wine, which they resinate in Homeric fashion.

The Moslems, prohibited by the Koran from wine drinking, content themselves with distilled liquors. In every neighborhood one or more Moslem families will own a copper still, complete with boiler and cooling screw, which someone once bought in Scutari or another town. Neighbors borrow these stills from time to time, as American families borrow each other's ice-cream freezers. Much of the *raki*, or raisin brandy, so produced, is home distilled, but a certain amount is carried up from the towns. Green *mastica*, a vicious local variety of absinthe, is imported only. Both Catholics and Moslems smoke. While a few Moslems own *narghilehs*, most tobacco addicts smoke cigarettes. The economics of cigarette smoking is that as a rule each man grows his own tobacco, and sells what he does not consume. He has to buy cigarette paper, imported from France. He has to have some kind of a lighting device, which usually runs to expense, as previously explained (see p. 13). The social aspect of smoking is that it forms a ready means of polite interaction, for men give each other cigarettes, rolling and licking them for an honored guest.

Since the principal food of all the mountaineers, whatever their religion, is bread, usually a tough, unleavened cornbread which will keep for weeks and grow harder and harder instead of molding, one of their principal needs is some way to grind the grain. Most houses contain mortars and pestles, and many also contain hand querns, of Roman design, which the women operate. It is probable, but not certain, that all of the millstones come from the market, since suitable stone is found in few areas. A large part of the grain-milling, however, is done in small, water-driven mills, of which there are many. These mills, homemade except for the stones, are operated by vertical-shaft paddle wheels which are in effect primitive turbines. They save the expenditure of human muscular energy, and much time. In one place in Malsia e Jakovës, I saw another kind of mill, a pounding device which consisted of a trough-shaped log set on a pivot, and equipped with a heavy hammer at one end. Water flowed into this trough until enough had entered the lower end to tip the whole,

and raise the hammer. Then when the water spilled out the hammer fell, and the cycle began again. These mills have been observed by other authors as well.

Although they utilize water power so cleverly and save so much effort, these 2 kinds of mills involve no specific division of labor. Some men may be more skillful at setting them than others, but there are no professional mill-builders, and no millers. Like the fulling mills they belong to the families that use them, and when not in use are unattended. In the cities, however, professional millers are to be found. Prizren, which has an ample supply of swift water running under the streets, is a milling town, and the traveler walking down the millers' street can hear the sharp ring of stone on stone for several hundred feet. These mills supply the needs of the bakers of Gonaj and Zum, and feed the citizens of Prizren. Bread from this region is of excellent quality and mountaineers coming to market often take a few loaves home.

The Ghegs eat one principal meal a day, late in the afternoon. In the morning a Moslem may take a small glass of *raki* for an eye-opener, and eat some bread and cheese; a Catholic will also break his fast. Both will munch a cold snack on the road or in the field for luncheon. But the time when the whole family gets together, when honored guests are entertained, comes when the day's work is over. Then the women cook the food, and the men squat around the communal table. In Moslem households the table is the only piece of furniture in evidence, aside from the omnipresent chests. Among the Catholics, each house usually contains one massive beechwood chair, made locally, which seats the head of the house or the guest of honor, and a number of low wooden stools.

Forks and other modern cutlery are usually absent. Mediaeval table manners are scrupulously observed, with all eating from the same dish, and with their fingers. Among the Moslems at least, the custom of passing a wash-bowl and jug of water with a towel before and after the meal is usual, as well as saying the Koranic grace, *bismillah*. At one meal which I attended at the house of Major Çen Eleze at Slatina, in Dibra, the table was at least 10 feet in diameter, the eaters numbered at

least 15, with as many more waiting patiently for second table, and the dishes included a whole roast sheep, which the Major picked apart with his hands and distributed.

Professional cooks are found only in the towns and in new government stations. In Prizren and Scutari, many of these cooks are Turks and their dishes consist mostly of mutton with various kinds of vegetables. Personally I found this cuisine very tasty. They also make a fine *yughurt*. Pastry cooks form another special group, and concentrate on *baklava* and *kadaif*, the two honey desserts familiar to eaters in Greek restaurants in all countries. Although their products may be carried into the mountains, the pastry cooks themselves stay at home.

The mountaineers obtain almost all of their own food by farming and herding. Hunting provides little or none for most families, and the same is true of fishing. Along the Black Drin, just above Kukës, a few fish are sometimes caught, and welcomed in the kitchen. In Prizren, fresh river fish are sold in the market. But fish is an insignificant element in the Mountain Gheg diet. The same is true of wild vegetable products, shoots, berries, and the like, collected by women. Furthermore each family produces practically all of its own food, except for a little coffee and tea, and a bit of sugar and salt. Most families are too poor to afford these imported luxuries often. The significance of the absolute self-sufficiency of the Ghegs in their food supply is linked with local differences in geology, and must have a profound effect upon differences in physique attendant on diet.

Farming is a family affair. The man buys the iron implements which he needs in town, and makes the rest of wood. He breaks the soil with a spade, and ploughs it with oxen. As he ploughs each furrow, his wife walks behind him with a basket of seed, sowing it. Later the women will do the weeding, and the whole family comes out to reap. If the crop is wheat, they cut off each head of grain with a sickle and put the heads in a bag; if maize, they pick the ears and braid the husks for drying. They thresh small grains and beans with flails. When the tobacco leaves are ripe, the men cut them carefully and hang them on their verandas or the sides of their houses to

cure. The Mountain Ghegs also grow much fruit on trees near their houses. The chief species are quinces, pears, and apples.

Women have charge of milking the cows and making butter, curds, and cheese. Small boys are usually employed as shepherds, and lead their flocks high on the mountains. In the summertime many Gheg families drive their cattle up to the Alpine meadows on the mountain passes, and keep them there weeks at a time while they make butter and cheese. While on these heights they live in small temporary houses (fig. 8, *c*). The people of Klementi, however, who live in high valleys, drive their flocks to the plain of Scutari every year for winter pasture.

Animal husbandry furnishes the Ghegs not only with much of their food, but also with a supply of energy, for they use oxen in ploughing, and horses for travel and the transport of goods. In the wintertime they keep their cows and horses indoors, while the pigs, in Catholic regions, have special sties. Late winter and early spring is the season when food is scarce. The corncrib may be empty, and only the seed corn hanging in bunches from the walls will remain untouched. The cows are dry, and the flitches of pork and bacon gone from the ceiling.

This is the time when the mountain people, their tempers more and more irritable, used to turn to raiding, and while some rustled each other's animals, others came down out of the mountains to steal cattle from the people on the plains. Mirdita raided Zadrima, and Mati raided the low country around Elbasan. This annual hunger was the result of a complete economic occupance of the land, coupled with an excess of births over deaths. Raiding brought in more food, but feuding caused more deaths. Between the two, plus a certain amount of emigration, the balance was reached.

Transportation in Ghegnia was, in 1929, as poor as anywhere in Europe. There were a certain number of roads over which people could walk, in some places ride animals, and in most, carry goods on animal back. In a few places the trails were too steep for animals, and men had to pack in goods by pannier. The principal road, which will be described later, goes from Scutari and Lesh by way of Vau i Denjë to Puka, then on to Kukës, and across

the border to Prizren. This was an old Roman road, and has probably not changed much in a thousand years. At Kukës another road meets it, running south along the Black Drin to Peshkopia and outside Gheg country to Lake Ochrida and Korça. Parts of this road had been widened for vehicular traffic in 1929, but the wide pieces had not been connected. It is said that both these roads have been opened for motor traffic since the Italian occupation.

Another trail goes from Tirana to Zall, thence to Gur i Bardh in Mati, through Klos, across the divide to Bulçiz in Dibra, and thence to Peshkopia. This is the principal route between the new capital and the important region to the northeast. Still another passes from Lesh to Bureli in Mati (fig. 9, *c*), following the banks of the Mati River. Bureli, now a prefect station, has grown important only with the Zog regime. From Bureli one can proceed to the northern Catholic country of Lura and Kthella, and thence down into Dibra, but the road is little traveled. North of the Drin a trail passes from Scutari to Shoshi over the Gur i Kutch, but in winter this is impassable. On the other side there is a road from Kukës across the Drin through the *bairaks* of Bituç, Gashi, and Krasniqi, past Merturi, into Shoshi (fig. 8, *d*). In winter this can be passed by men but not animals. Hence in wintertime no animal traffic can enter either Shoshi, or Shala which lies to its north. Before the boundary was drawn between Albania and Yugoslavia the road from Tropoja, in Gashi (Malsia e Jakovës), to Jakova was much traveled; but now this is forbidden and the people of this tribe must go to market in Kukës.

As far as any considerable traffic is concerned, horseback and human back are the only methods of land transport available in Ghegnia. In a few of the flatter places, however, other means are used locally for short distances. In the country around Scutari just below the mountains, the farmers use carts, particularly in Zadrima. In Lumë, on the flat land at the confluence of the Drins, and in Has on the other side, carts are likewise used, as well as ox-drawn summer sleds.

Crossing streams is not a simple matter in Ghegnia. Most of the crossings are fjords, and very cold. I have seen men strip naked to swim across icy rivers in search of a place for

animals to cross, and have waded up to my chin at night, with snow on either bank. When the streams are swollen, animals and men are not infrequently drowned. There is or was an old Turkish bridge across the White Drin, from Kukës to the northern bank (fig. 9, *b*). Several wooden bridges crossed the Black Drin in Dibra. On the road from Krasniqi to Shoshi, I have crossed a bridge which consisted of 2 poles, one to walk on, the other a little higher and to one side, to use as a rail.

In a few places, ferry boats are available, which operate by the principle of changing the mooring position of the cable after each crossing, so that the power of the stream will push the boat diagonally across to the other bank. There was one such at Kukës across the Black Drin, another at Bureli over the Mati. Other observers have witnessed Ghegs crossing these streams on inflated skins, but I have never seen it.

Navigation in Ghegnia is very limited. Although Nopcsa has a picture of a man in a boat at Merturi, I have seen it only on the lower course of the Drin, between Vau i Denjës and Scutari, where special boatmen ferry passengers to town in a few hours, to save the day's march over the road. These boats are long dugout canoes, usually double. The boatman propels them by sculling, like the gondoliers of Venice. The men who run the ferries, and these boatmen on the lower Drin, are without doubt specialists, as nearly fulltime as the traffic requires. Probably not more than a dozen men ply these trades. Much more numerous are the *kiragis*, the professional horse-drivers who may be seen on all of the roads in Moslem country, and in some Catholic tribes as well. The *kiragis* in our series were Dibra men, but others come from outside the tribal area, from such places as Elbasan and Tirana.

The *kiragi* is a hard-bitten man, disillusioned early in life by a close observation of human behavior under stress, since all travel in Ghegnia is difficult. He is a non-combatant, a man with no family ties in the regions in which he works, and not worth killing. Anyone who robs him too often will keep trade away and cut off the supply of needed imports. He will rent out anywhere from one to a half dozen horses, to go anywhere the road will take him, and the rate per day has to be argued over at length. He insists on taking grain for his

horses at the customer's expense, and will refuse to go on if the grain is exhausted. All kinds of situations arise to produce arguments between *kiragi* and customer, such as the unexpectedly high price of grain in a certain place, inn charges, and the condition of the horses.

Besides carrying passengers and their goods, the *kiragi* will do errands; he will carry goods to market without their owners, sell them, and take his commission; then he will bring back a specified list of purchased objects. He must be reasonably honest or he will lose the traffic. At the same time the mountaineers who hire him are spared the risk of crossing hostile territory.

Kiragis are either in business for themselves or in partnership, or working on shares with an investing capitalist. Since Islam prohibits interest, the share system is the one employed. It is not big business, for the maximum number of persons involved will not exceed a half dozen, including the boys whom the *kiragi* takes with him to help with the horses. It is, however, one of the few ways in which the otherwise closed country of the Gheg mountaineers is systematically and constantly penetrated. In 1929 there must have been at least a hundred such professionals on the roads every day.

In Moslem country the principal roads are equipped, at appropriate distances, with inns. As with tourist cabins in the United States, it is best to start at daybreak or earlier, and get in well before sunset, for the inns are often full well before night. The usual inn consists of 3 rooms; a large stable, which occupies about three-fourths of the whole; a chamber with a low ceiling built into one corner of the building, some 14 feet wide by 30 or 40 feet long, with a fireplace at the far end; and a cubicle which serves as the *hanji's* (innkeeper's) private quarters, office, and store.

When you enter the inn, the *hanji* sees that you unload your animals, and assigns them space in the stable. He has straw there, and sometimes grain if you have not brought your own. Then he gives each guest a section of the floor, which is divided into 3 strips, the 2 on the sides being about 6 feet wide, and the center one, 2 feet. Guests sleep side by side on the lateral strips, with the center reserved as a passageway. The guests feed themselves,

with cooking privileges at the fireplace, while the host brews coffee for sale, and also dispenses *raki*. After his guests are in for the night he locks the door, and cannot ordinarily be persuaded to unlock it before morning, no matter how urgent the needs of the guests to go outside. This precaution is necessary owing to the frequency of violence.

Some of the *hanjis* are local men. Others come from Kruja, the home of innkeepers. All of them live as bachelors. This system, like the *kiragi* business, brings a certain number of outsiders into the country. All in all there are probably 12 to 18 *hans* in Ghegnia, in addition to the one European-style hotel at Peshkopia. The Catholics do not use this system; in their tribal areas guests are put up by important individuals through a system of reciprocal hospitality. Since local feuds are usually more prevalent in Catholic than in Moslem country, travel across the former is relatively light.

There remains only the question of trade, which has been partly covered. On the whole it may be said of the mountain Ghegs that they live by a regional, or geographic, and perhaps also ethnic, division of labor. The ordinary man is a farmer, who produces firewood, cereals, legumes, tobacco, wool, milk products, and sometimes wooden spoons. His wife produces cloth, crocheted stockings, embroidered scarfs, baskets, eggs, and a few other local products. These mountain products find their way to the market towns. Usually men and women come together; sometimes only the women make the trip, and sometimes the whole family stays at home, sending the goods by a *kiragi*.

The Ghegs are able to export these things because they produce a slight surplus of agricultural products. One reason for the surplus may be that they use a number of labor-saving devices, including fulling and mealing mills run by water power. This gives them more time for other pursuits, but does not increase their complexity of relations at home, since the mills are small and serve individual groups of related families.

On the other side of the picture lie the craftsmen and shopkeepers in the towns, some Albanian, others Turkish, others Serbian. These craftsmen live off the exports from the mountains and from the other agricultural regions around them, and supply the mountaineers with their needs, including firearms and ammunition, as well as the objects previously listed.

So far the picture is simple, mountaineers on one side of the fence, townsmen on the other. A mountaineer may become a townsman, but never the reverse. At several points, however, the security of the mountains is penetrated: by the itinerant masons who build *kullas*, by the *hanjis* and *kiragis* who handle traffic and care for travelers, and by the shopkeepers, who are themselves usually Ghegs, and who are found in the larger tribal villages, usually but one to a settlement. I can recall but one in Mirdita, none in Shoshi, while in the country villages of Dibra, Luma, and Puka, along the main roads, there were several. These men sold tea and sugar, needles and thread, cigarette papers, salt and pepper, a little candy, candles, kerosene, kerchiefs, and matches. They saved a trip to town for minor purchases.

With this balance of production and trade, the Ghegs barely succeed in making a living. If their average income could be accurately assessed, it would be one of the lowest in Europe. The ordinary farmer has just enough clothing to cover his family. In some cases I have seen brothers with one suit between them; one had to stay indoors while the other went out. This was in Merturi. The ordinary household has just enough food to get through the year, saving the next year's seed and selling a little in the town. Many houses are the scenes of tightened belts and near starvation every spring. Since there is no knowledge of contraception, many children are born. As ideas of sanitation are also lacking, many people die, and the population is always a little greater than the threshold of tolerance. Feuds, sudden death, and emigration are necessary safety valves. Another very recent one is enlistment in the gendarmerie.

THE FAMILY SYSTEM: WHO MARRIES WHOM AND WHY¹

TO THE anthropologist, selective marriage systems, such as cross-cousin and parallel-cousin, are run-of-the-mill phenomena. But the anthropologist is used to dealing primarily with non-European peoples, living far from centers of civilization. To the sociologist brought up on European and American subject matter it is an event to discover a "primitive" system in operation only 250 miles from Rome, in the 20th century.

As our study of material culture made clear, the Gheg family, like that of the early Israelites, or of the Chinese of any period, is an economic institution. One household, consisting of a man, his wife or wives, his sons, unmarried daughters, and son's children, lives in a single house or group of houses, and all ordinarily work together. The most complicated tasks which confront them require the co-operation of such a group, but no more, except in rare events when neighboring kinsmen may be called in. Isolation and political insecurity enhance the frequency and strength of the mutual relations of the family members. In some of the tribes, notably Dukagin, these households number up to 30 or 40 persons; the Arabic word *mehalla* (military camp) is used to designate them.

A sex division of labor clearly separates the work of the women from that of the men. Each needs the other. A houseful of widows and unmarried women would be unthinkable, as would a house occupied by men alone. The family must be a balanced unit. If a man dies his place must be filled if possible; if a woman fails to bear children another must be found who can. The family must continue, and since so many men are killed before they reach maturity, it must produce boys. The birth of girls is less important because they are not killed, and because they leave the family to get married.

For a number of very good reasons, it is considered desirable to obtain wives for one's sons from a distance. In the first place, if a

boy were to marry a local girl, he might get in trouble with other local boys. Young men form attachments for the girls whom they see every day, and any feeling of rivalry in youth which was followed by such a marriage might continue the tension into manhood. The young men who live in one place must get along together as well as possible. Owing to economic pressure, all tensions run high, and tensions result in violence. Violence with one's immediate neighbors would be suicidal. Therefore it is best for fathers to arrange these matters well in advance, and to bring in new girls who have no local ties.

Then again, let us suppose that the marriage did not work well; that the bride was shy, disliked her husband, was slow to adjust herself to living with him, or resented her mother-in-law's interference. If her parents lived close at hand, she could run home and complain to her mother. Soon her father and brothers would be making trouble for her husband and his family. Any wise person can see that it is much better to bring the bride from a distance, and then if any trouble arises between the two kins, they will be too far separated to cross each other's paths very often.

Once a family has formed the habit of getting its wives from another group in a distant area, that habit is likely to continue. A man will go to his wife's brother and say, "Haven't you a daughter for my son?" and the thing is easily arranged, providing that the earlier marriage has been successful. This requires less effort than breaking the ice with an entirely new group of people, but at the same time it preserves the necessary distance. Of course, if the man's wife's family has no daughters available for his son, he can try their neighboring kinfolk, or some other family with which some of his cousins have worked out a similar arrangement. In this way 2 things are evened up; one does not give a girl away without some assurance of getting in return a wife for one's own son.

¹ The principal source of this chapter is my own records. However, I also made use of Miss M. E.

Durham's publication of 1928, as well as material contained in a letter which she most kindly wrote me.

This system satisfies the universal principle which applies in all human mating, that *the ideal or normal choice of spouses shall be that which creates the least disturbance in the systems of relations of both parties concerned*.^{1a} That a form of cross-cousin mating should have survived in the Gheg country is a natural consequence of the equal survival of an archaic technology in a rugged environment. The system fits the circumstances, as one might expect.

reproduction; that it is dishonorable and unthinkable to marry any kin whatever. Since the mother's family is no relation, sons can continue to take their brides from it for generation after generation. The Law of Lek Dukagin, which the Gheg father would quote on such an occasion, has taken care of this subject once and forever.

The choice of a bride for his son is as much a political problem to a Gheg householder as it was to a 19th-century European king in the

TABLE 1: NUMBERS OF WIVES MARRIED BY FATHERS OF SUBJECTS, AND NUMBERS OF OFFSPRING.

	ME	DUK	MEJ	HAS	LUM	PUK	MIR	ZAD	MAT	DIB	INT	TOTAL
One Wife, Moslems.....	40		54	72	76	50		9	69	74	3	450
Catholics	47	89	10	10		24	82	83	9		2	356
Total	87	89	64	82	76	74	82	92	78	74	5	803
Two Wives, Moslems	12		27	19	23	13		3	20	32	1	150
Catholics	5	16	5	3		12	16	7	1		3	68
Orthodox											1	1
Total	17	16	32	22	23	25	16	10	21	33	4	219
Three Wives, Moslems.....			4	7	8	1		1	4			25
Catholics			2				1	1				4
Total			6	7	8	1	1	2	4			29
Four Wives, Moslems			1		2	1						4
Catholics		1					2					3
Total		1	1		2	1	2					7
Six Wives, Moslems.....			1						1			2
Total Fathers	104	106	104	111	109	101	101	104	104	107	9	1060
No. childless 1st wives.....		6	8	4	2	3	1	1	4	6		35
With daughters only.....	1	7	2			4	3	3	4	2	2	28
Total unsatisfactory 1st wives in plural marriages	1	13	10	4	2	7	4	4	8	8	2	63
No. boys born.....	400	317	332	366	394	325	300	298	271	365	31	3399
No. girls born.....	283	237	201	239	227	188	165	159	167	184	17	2067
Total children.....	683	554	533	605	621	513	465	457	438	549	48	5466
No. children per family	6.6	5.2	5.1	5.8	5.7	5.1	4.5	4.4	4.2	5.1	5.3	5.2
Sex ratio of children.....	141	134	165	154	174	173	182	187	162	198	182	163

However, the Gheg father, if asked, would not give the answers detailed above as reasons for his choice of a bride for his son. He would voice a number of local rationalizations: that the son inherits body and soul from the father alone, the mother being merely a vehicle of

heyday of royalty. No mistakes must be made, and the preferences of the parties concerned are not considered important. Hence the fathers make the arrangements. A man normally pays 15 to 20 napoleons (60-80 dollars) for his son's wife. This is half the price of a

^{1a} Coon, 1948, pp. 602-03.

new *kulla*. If the man has many sons, the youngest may not get a new wife, but have to content himself with a widow, who is cheaper. Also it may take some time to find a fiancée for each boy, and many young men wait until quite late in life for marriage.

The principal reason for this delay, aside from the price, is the peculiar birth and death rate figures for Ghegnia. Many more boys than girls are born. In some regions the boys outnumber the girls almost two to one (see table 1). However, as soon as a boy is big enough to carry a gun he may begin feuding, and stands a good chance of being killed. Then his marriage arrangements may be transferred to his brother, or cousin, and hence the young lady may marry someone quite different from her expectation.

The alert and provident father, ever on the lookout for daughters-in-law, may place a substantial part of his bride price on a baby girl, as soon as she is born. Or he may gamble on the sex of an unborn child. The baby girl may find herself, at the age of 14, married to a man of 40. Once she has been handed over to her new husband and the folk-rites performed, she is still on trial, and may be sent home if she fails to produce offspring within a reasonable time. Among the Catholics the church wedding is often delayed until after the birth of the first child. In this way the bride can be returned if found wanting, and the rule of Christian monogamy will not have been technically violated. Among the Moslems, where both polygyny and divorce are officially permitted, these subterfuges are not needed.

While the Gheg system of selecting mates may be well attuned to the exigencies of the environment, the economics, and the political life of the mountaineers, it permits little opportunity for personal adjustment between the husband and wife. Prince Jon Markajon (fig. 10, *a*) summed this up when he said to me, gloomily, in the presence of his wife, "There is only one woman a man can trust—his mother." In the cases where cross-cousin marriage works out ideally, the boy and girl may have met before betrothal, or at least before marriage. The boy's mother, on a visit to her own kin, may take her youthful son with her, and he will have a chance to play with his

maternal uncle's children. Then when the bride joins her husband in his father's house, she will come directly under the supervision of her paternal aunt, a woman whom she has already seen, and who represents an extension of her own family in the strange household. Such an ideal arrangement still makes no provision for a selection of mates on the basis of personality adjustments. It merely makes the change from one household to the other a little easier than if the girl were a total stranger. Very often a girl's fiancé is killed and she has to marry one of his brothers, a cousin, or someone of an entirely different family, and there will be no familiar aunt to smooth things over, but instead a suspicious and exacting mother-in-law, with whom her only ties are through her husband.

It is no wonder that brides sometimes run away. If they come home their fathers usually return them. Not infrequently they elope and if they are lucky settle in some city, or distant countryside where the limb of Lek Dukagin's law is not long enough to reach them. Gheg epic poetry, which the traveler hears sung night after night in private houses, hans, and gendarmeries, dwells frequently on the theme of elopement. One hears at length about couple after couple, hopelessly in love, who break all of the rules, run away, and meet a tragic but inexorable fate. In the epics they seldom if ever make good their escape. In real life I believe that they sometimes succeed, and their elopements, successful or otherwise, help reduce the population of the mountains.

If a young woman is faced with a marriage which she cannot bring herself to consummate, and if she has enough strength of character to take the following step, she can avoid matrimony by becoming a "sworn virgin" (fig. 10, *d*). She summons a meeting of the 12 elders of her community and in their presence swears perpetual chastity. By this means she not only gets out of her engagement, but also prevents a feud between her father's kin and those of her fiancé. At this point she becomes technically a man. She may or may not don masculine clothing. She will carry a gun, and fight like other men. She will plough and reap, and do all of the tasks of a man. If she breaks her oath, the elders will, in theory, burn

her alive. It is doubtful if this punishment has been exacted on any such person within the last few generations.

As the reader can readily see, this custom has its economic aspects. The number of hands available for men's work is increased by two, that for women's work decreased by the same number. There is a second and less dramatic reason for a girl to swear virginity: if her father has no sons to help him with his work, or if his sons are killed. Then a daughter may step into the position of a son, and the situation is momentarily saved. However, since the pseudo-son will have no offspring, the line will become extinct with her death, and the property pass to the next of kin on the father's side. This custom is at variance with the usual one in comparable societies, in which the husband of the man's daughter comes to live with her parents, and is adopted as an heir. So strong is the belief in the continuity of the male line that this could not be done in Ghegnia.

On my travels I encountered only 2 sworn virgins. One wore men's clothes, and appeared to be either mentally defective or at least "queer." That also was her reputation. The second wore women's clothes. She was in her early twenties, and quite attractive. Since she spent the night with a junior member of my group of horse-drivers, I formed a poor opinion of the burning-alive theory. It is quite apparent that the practice of swearing virginity is not only often economic in motivation, but also a part of the whole business of local population control, along with the entire configuration of pride, insult, and feuding.

Two other mechanisms help maintain the personnel of the family at the optimum numerical working level, and to prevent the isolation of separate individuals or small, un-economic groups. One is the levirate. Classically this means that when a man dies, his widow will be married to a surviving brother or next of kin if such a brother is lacking. In a country where the rate of death by violence reaches the level of 40 per cent of all male deaths in some localities, and where girls are married at 14 or 15, many are widowed.

Such a widow must be cared for by the men of her husband's family, since they have paid

for her and she has joined their group. If there is a surviving brother who is single, obviously the expedient thing to do is to give her to him. She might even be given to a first cousin. However, the occasion sometimes arises in Ghegnia where the classical form of the levirate is indicated, and a brother, preferably an older brother, of the deceased, a man who is already married, takes the widow into his household. In Moslem communities this causes no ecclesiastical difficulty. In Catholic households it may bring about a conflict with the priest. In such a case the Law of Lek wins over the Law of Rome. Societal needs are stronger than religious taboos. The new husband may not be allowed a church marriage, and it is possible that he may not consummate the new union, but the woman enters his household, and he cares for her and her children.

The second mechanism is polygyny, in case the first wife fails to produce male offspring. This again is perfectly legal among Moslems and diametrically counter to Catholic rules. The priest will not allow the husband to divorce his wife who fails to give him sons. If she gives him daughters there is always hope that a son will follow, and the crisis may be delayed. But if after a suitable time there are no offspring whatever, he will need a new wife. He cannot divorce his old one, and he cannot legally marry his new one. Here again custom sometimes wins. I personally have visited only one household of Catholic Ghegs in which I knew that the master had 2 wives, and it was for this reason. It is little wonder, since Catholicism fits so imperfectly the economic needs of the Albanian family, that many of them went over to the much more satisfactory (in this respect) faith of Islam.

In making up the form of our measurement blanks before the expedition, Dr. Hooton and I allotted spaces for the notation of the following vital statistics: number of wives married by subject's father, and number of children of each sex born to each wife. We chose the subject's father rather than the man himself because we would thus be dealing with complete or nearly complete families. In every case we received specific answers; very few men, whose fathers had had 3 or 4 wives, could

not remember how many children the oldest wife had had.

These statistics do not constitute a record of pregnancies. Children who died in infancy are probably not included. Female infanticide has not been reported in Ghegnia. Presumably all or most of the children grew to such an age that either they were still living in 1929-30, or were old enough at the time of death to have made an impression on their full or half brothers who were our subjects. Our figures tell how many wives each father had, but not how many at a time. It would be hard to get that information from a casual questioning done in public at the time of measuring. In 1929 polygyny was legally forbidden in Albania for Catholics and Moslems alike, and the Catholics had in addition the position of the church to keep them from revealing the polygyny of their parents in the presence of several dozen other people. One other obvious defect of our data is that we have no record of marriages in which no son was born, and no second wife taken. This circumstance, although rare, must have occurred. The reader may think, in view of the unusual sex ratio, 163 male to 100 female offspring, that Moslems failed to reveal the true number of girls born, but I do not believe that this was the case. The Catholics had the same sex ratio as the Moslems. Furthermore, if many more children had been born than were recorded, the reproductive systems of Gheg mothers would have been taxed beyond their capacities.

As table 1 reveals, 1060 Ghegs married 1375 women. Three-fourths of the men had but one wife each, the rest anywhere from 2 to 6. A third of all Moslems married more than once, compared to a sixth of Catholics. The greater plurality on the part of the Moslems reflects the greater fertility of the soil in the eastern tribes, which are almost wholly Moslem, and where a man can afford more wives and feed more children. The wholly Catholic tribes, Mirdita and Dukagin, are the poorest in Ghegnia. Where the Catholics and Moslems live together in about equal numbers, the Catholics marry as many wives as the Moslems. In fact, in Puka the Catholics had more. Religion therefore has little to do with the total number of wives a man marries, although it

may have something to do with the number to whom he is married at one time.

Our statistics give us a little help in finding out why 256 Ghegs married more than one wife. In 82 cases, or 32 per cent, the first wife failed to provide her husband with an heir, although in 28 of these cases, or 11 per cent, she did produce one or more daughters. Since we do not know the date of birth of each child, we cannot be sure that some of the first wives who bore sons did not do so after a second wife had been taken, and the ratio of plural marriages concluded for this reason may be higher than our figures indicate. Some of our records reveal marriage after marriage without issue, until finally, the fourth or even the sixth wife bears a son. One can almost hear the gunfire and rejoicing.

Our intertribal mixtures, in 5 cases out of 9, were men whose fathers had taken more than one wife each. Of the 4 Has men whose mothers had come from Podrima, 3 had been reared in polygynous families. These figures strongly indicate a political motivation. The custom of taking plural wives from alien tribes in order to strengthen alliances is a widespread one, and goes back to the days of Solomon. Our figures are not suited to reveal the exact instance of this kind of exogamy.

These 2 reasons probably account for nearly a half of all plural marriages. The other half can easily have been caused by accommodations to untimely deaths. Upon the death of a man, the levirate might give one of his kinsmen a second wife. Upon the death of a woman, her husband would remarry, were he able. What with difficult deliveries, puerperal fever, and general exhaustion from having borne too many children in rapid succession, death must have taken many of the women listed in our series at an early age.

The figures on children show that 1060 fathers, through the agency of 1375 wives, produced 5466 offspring who lived long enough for our subjects to remember them. This yields an average of 5.2 children per family, of whom 3399, or 62 per cent, were boys. Thus the average Gheg householder had 3.2 boys to help him work his farm. He had only 2.0 daughters to sell in marriage. This birth rate is so high that a considerable population

pressure is created. It varies from 4.2 in Mati to 6.6 in Malsia e Madhe, with the largest families on either side of the mountains, the smallest in the middle. Even the smallest are too large for the landscape to feed without a change in methods of land utilization, a change which has not yet arrived.

In the country near Scutari, the city will take some of the excess. In the lands east of the Black Drin, migration onto the plain used to be possible, and habitual. Cvijič has shown² how, along the entire Dinaric chain, there has been for centuries a steady flow of population out of the mountains. In the center of the mountains, however, such emigration is not easy. Particularly in the old days when Catholics were not welcome in Moslem territory, the mountain people had to stay at home. There is only one universal, immemorial method of disposing of excess population under these circumstances. That is the method found in the Rif, in the Caucasus, in the Kafir country of Afghanistan, and in many other places—feuding. If enough males are killed off, the population remains constant.

Males only are killed. A few statistics on deaths by violence are available.³ During the period 1901–05 the ratios in a number of northern communities were Toplana, 39 per cent; Dushman, 23 per cent; Spaç, 32 per cent; Shala, 26 per cent; Orosh, 21 per cent; Nikaj, Shoshi, and Kačinari, 25 per cent each. Double these figures and one finds between 42 per cent and 64 per cent of males dying in internecine warfare. As if some natural mechanism were deliberately trying to compensate for this one-sided loss, we find a sex ratio of 163 male births to every 100 females born.

Sex ratios of this magnitude have been found before in feuding countries, and in fact the ratio of male births has been shown to rise in our own country in time of war. The biological explanation⁴ is that people living under conditions of warfare marry and produce children at an earlier age than they would in time of peace. Some mechanism upon which all biologists do not agree selects the sperm cells, or the fertilized eggs, in the mother's

reproductive organs. That is why first-born children tend preponderantly to be boys. It is the age of the mother that counts. In northern Albania girls are married as soon as they come to sexual maturity and begin bearing children as soon as they are biologically able. There is no time of peace.

These statistics, though not complete, help round out the picture drawn in the earlier chapters. All of these things fit together: the environment; the techniques of making a living on the specific kind of landscape; the division of labor between the sexes; the economic unity of the patriarchal household; its independence of similar households; the division of labor between mountain and town; the consequent absence of any need for a technological division of labor among the mountaineers; the difficulty and limitation of travel and transport; the struggle for life within an ever-increasing population; the consequent mechanisms of population control, consisting in some of the border tribes of a certain amount of emigration, but, by and large, taken care of by the time-honored technique of feuds and reciprocal murder, to which the whole system of marriage, and its biological compensations, are adjusted. They show without question the truth of the main point of this paper so far, that the Mountains of Giants form a genetic area peculiarly closed to outside influence.

We stated in our discourse on marriage that a boy might not marry a girl with whom he could trace any common patrilineal descent. That statement needs elucidation. Actually the Ghegs are divided up into a number of mutually exclusive gentes, called *fis*, based on traditions of common ancestry, complete with origin myths. The extent to which the myths are historically accurate probably depends on how far back the particular *fis* goes. Each *fis* is said to have been derived from a single man, usually someone who came into the country at one time or another, although a few are believed to have been descended from aborigines.

The most numerous and best known *fis* in Ghegnia is that of Dukagin. This includes the 3 *bairaks* of Orosh, Spaç and Kushnen, which

² Cvijič, 1918.

³ Nopcesa, 1925. Data compiled by the Catholic clergy.

⁴ Gates, 1946, vol. 2, pp. 872-73; Little, 1919, pp. 127-30.

constitute three-fifths of Mirdita, as well as Shoshi and Shala in the tribe which bears the Dukagin name. There are 2 origin myths, one told in Dukagin, the other in Mirdita.

According to the first legend, 3 brothers came from a place called Marina near Jakova. One carried a winnowing sieve (*shosh*) and became the ancestor of Shoshi. The other carried a saddle (*shal*) and sired Shala. The third carried nothing, said, "*Mir dit*" (Good day) and walked away. His descendants are the people of Mirdita. The Mirdita people tell a more detailed story. They list 5 brothers, Shosh and Shal as before, named for the objects they carried, and 3 others who settled Mirdita—Orosh, Spaç, and Kushnen. The meaning of these words is obscure.⁵

In Mirdita where these 3 brothers settled they found other people ahead of them, the ancestors of the inhabitants of the 2 remaining *bairaks* of Dibri and Fan. Dibri and Fan had several kinship lines each, hence each consists of a number of *fis*. Orosh, Spaç, and Kushnen *bairaks* form a single exogamic unit today. They take their wives from Dibri and Fan, from the Christian *bairaks* of Selita and Kthella in Mati, and they did from Lura before they fell in blood with them. They also marry Christian women from the 7 *bairaks* of Puka. No man from Orosh, Spaç, and Kushnen can marry any woman from these 3 *bairaks*, or from Shoshi or Shala.

Shoshi and Shala form an isolated geographical unit, with Shala at the high and Shoshi at the low end of an enclosed upland valley. It is not easy to enter or leave this area. Hence the marriage restrictions between the two, if they ever existed, have disappeared, and Shoshi men regularly marry Shala women, and vice versa. The local rationalization is that over a hundred generations have passed since the time of the 2 ancestral brothers, long enough to remove any trace of consanguinity. By the same token they could theoretically marry their fellow *fis* members from Mirdita, except that the Mirdites would not agree. In any case

the 2 tribes are so far apart, and so isolated, that the occasion would not arise. Shosh and Shala, like their brothers, found aborigines in their valley; with the descendants of these earlier residents they too can form convenient short-distance unions.

Merturi and Nikaj, the 2 Catholic *bairaks* of Malsia e Jakovës (the other Catholics, those of Krasniqi, migrated en masse some 30 or more years previously to Jakova) regularly intermarry, back and forth, like Shoshi and Shala. In general the larger exogamous units are found among Catholics, the smaller among Moslems. Most Moslems feel that 7 generations distance between kin is enough to permit marriage, which means that brides are usually taken from nearer home. North of the Drin, and in Mirdita, even when there are several intermarriageable *fis* in a single village, village exogamy is required. In the Moslem tribes to the south and east this is said to be unnecessary. In the town of Gur i Bardh, in Mati, we were told that village endogamy is usual. There can be little question that the Catholic system as practised in Mirdita, Dukagin, and Merturi-Nikaj is historically the older, and is the more closely associated with isolation and intense feuding.

In the next chapter we will go into detail on the number and locations of various *fis*. Here it is enough to state the principle, amply demonstrated by the evidence, that where there has been little travel and a minimum of immigration, one finds single kinship groups occupying wide areas, as in the cases just mentioned. Where there has been more travel and moving around and changing of domicile, one finds many little kinship units in a relatively small area. Thus in Puka, where the main highway passes, there are dozens of *fis*, of a few households each, and the same is true in the more traveled parts of Luma and Dibra, and in the neighborhood of Scutari.

The *fis*, as we have seen, is the basic unit of exogamy. Like all human institutions and aggregations it is a mobile unit, never com-

⁵ The Mirdites claim that *spaç* meant "sickle," *kushnen*, "pitchfork." I did not learn what *oro*sh was supposed to mean, nor can my Albanian friends in Boston identify it. *Orosh* may, however, be the same as *Urosh*, a Slavic name, borne by the son of the Tzar

Dushan, who despoiled the lower Drin country at the end of the 14th century (see page 43). It is obvious that these contemporary translations of the ancestral names are apocryphal.

pletely static. It changes with local needs. We have seen how in Dukagin the local geographical requirements split a *fis*, and how in the relatively less warlike Moslem areas with a reduction in need for extended exogamy, the device of a 7-generation distance was innovated, while village exogamy disappeared. So far we are dealing with reductions in exogamy. However, there are instances in which the opposite occurs, and the incest group is extended. Two ritual mechanisms provide for this, blood brotherhood and godfatherhood.

When 2 men become close friends and allies, and find themselves in need of each other's assistance, particularly in feuds, their relationship becomes similar to that of brothers, which is an extremely close one. It is therefore considered necessary that they make this relationship legal, which they do by means of a simple ceremony. The 2 men prick their fingers with knives, and either lick each other's blood, or bleed mutually into a cup of *raki*, which both drink. Once this has been done they are one in blood, and their children cannot marry each other. The other rite, godfatherhood, has its

motivation in exactly the same circumstances; but it is made to coincide with another rite of passage, that of the first haircut of a baby boy, the son of one of the participants. The father, child, and prospective godfather meet outdoors, in the presence of other kin. The godfather holds the boy in his lap, and snips off 4 locks of hair, if Christian, and 3, if Moslem. The difference lies in the refusal of the Moslem to make the sign of the cross. The godfather then burns the hair. A feast follows, during which the godfather gives the father a present of cash, the father reciprocating with a gift of fine clothing.

Both of these rites place the descendants of the 2 principals in an incest relationship. They do not, however, apply to collateral kin, for if *A* and *B* become blood brothers or godfathers, *A*'s brother's son can still wed *B*'s daughter, while *A*'s son cannot. This complicates the picture beyond this simple *fis* system and provides a number of special relationships to meet individual requirements. Needless to say, the local Catholic clergy frown on both these practices.

POLITICS AND FEUDING

THE smallest political institution in tribal Ghëg society is the household, the extended family living together, which is also an economic institution. The head of the household is the oldest male of the parental or grandparental generation, the patriarch. So strong is the feeling for age-grading in Albania that men will obey their fathers as faithfully at 40 and 50 as in their teens. Since all sons do not necessarily live with their fathers, but some may occupy separate houses, the institution of the household may thus be expanded spatially, although the relationships are maintained.

The household is a unit of warfare; when a man commits murder within his own tribe, his household suffers together. In seeking vengeance, a man can wipe out the blot on his family honor by killing the brother of his enemy; responsibility is held to be collective. If one member of a household kills another, which happens but very rarely,¹ nothing is done. The loss is that of the family.

The next unit is the village. It may be a compact group of houses, surrounded by its farmland and pasture; or it may consist of isolated homesteads, each in its own land. The latter is the more usual form. In either case, it has some central building, a mosque or a church; or it may merely have a flat place, usually shaded by an oak, where the elders meet. Each village is supposed to have 12 elders, whose office is partly hereditary, partly elective. Various families habitually furnish one man each to fill this position. The word for elder is *plak*, which Miss Durham traces back to the time of Strabo.² One of these elders is the *kryeplak*, literally, head elder. In one village in Has, when I measured the *kryeplak*, he told the recorder that he was "mayor" of the village. He calls the elders together when events arise that need their

attention. These include the use of tribal lands, decisions whether or not to burn forest to make pasture, etc., although such matters usually involve several villages. The elders also convene as witnesses in oath-taking.

Above the village is the *bairak* (Turkish for banner, standard), a geographical area with some kind of natural unity, so that the people living in it habitually see more of each other than of those without. All of the village councils meet together for the *bairak* council, under the *bairaktar* (standard-bearer), or head of the *bairak* (fig. 10, *e*). His office is hereditary in certain families. King Zog's father was *bairaktar* of Mat, the principal *bairak* of Mati; in Dibra Major Çen Eleze, who acted as host to our expedition, was one *bairaktar*, while Murat Kaloshi, his rival, was another. These men were great feudal leaders, maintaining large households of armed men, and dispensing lavish hospitality to all comers. Çen Eleze had sent two of his sons to the American Technical School in Tirana, where they learned modern agricultural methods as well as perfect English. These boys, huge fellows over 6 feet 3, were of great help to us when we visited Slatina.

The *bairaktar* can become an independent sovereign if he has a strong enough personality and if the tribal authority is weak, and that of the central government likewise. At other times he is under the authority of the head of the tribe, an official chosen from a ruling household, and bearing a different title in each tribe. In Mirdita he is called *Kapedan* (Captain); in Puka, *Shpij e Krye Ziut* (Black-Head House); in Malsia e Madhe, *Shpij e Madhe* (Big House), the exact equivalent of the ancient Egyptian *per āa*, or Pharaoh.

Fifty men, comprising 5 per cent of our metrical series, were office-holders in the Ghëg tribal system. Eleven³ were elders, 26 chief

¹ Miss Durham gives one instance from Dukagin (Durham, 1928, pp. 69-70).

² Durham, 1928, p. 14.

³ Four from Dukagin, 2 Puka, 4 Mirdita, 1 Zadrina.

elders,⁴ 8 *bairaktars*,⁵ and 5 retainers of a tribal prince, Jon Markajon of Mirdita (fig. 10, a). Except for the chief elder of Karashegeç in Has, who was a baker, all of the elders, chief elders, and *bairaktars* were farmers. The baker was "mayor" of a village of bakers, outside the mountain area. All of these men were locals, born of local fathers and mothers taken from within the father's tribe. Preferences are thus shown for (a) agriculture as against handicrafts or trade, and (b) local as against outside descent.

Jon Markajon, the only tribal chief whom we met, and who entertained us very well at his capital in Orosh, would not allow us to measure him, although he summoned all of his subjects from nearby villages. The 5 retainers whom we measured in his house constituted his princely staff. Three of them were part-time farmers, and 2, full-time political employees. What their exact duties and titles were, we did not determine. The ancient tribal government of Ghegnia, if we may judge by the example of Mirdita, the one tribe in which it survived more or less intact until 1929, consisted of a graded hierarchy with three steps—elders and their chief, *bairaktars*, and tribal prince. Attached to the prince was his staff of special messengers, chamberlains, and guards.

The tribal government was in the hands of the prince and his council, which consisted of all of the elders of the tribe, with their chief elders, and the *bairaktars*. The heads of large and powerful households, even if they held no formal office, would be included. The council met in cases of murder within the tribe, of intertribal warfare, invasion, or other crises involving violence. It also met to decide on its own composition, i.e., to hear the petitions of neighboring *bairaks* to join it.

The strength of the prince as compared to that of the council depended on the former's personality. During the last 50 years, for example, Mirdita has been ruled by the following princes: Bib Doda, a great and powerful man who died about 1913; Preng Bib Doda, his son, who was killed shortly after in a blood

feud; his cousin, Marka Gjoni, a weak character; his son, Jon Markajon, the incumbent in 1929, a man powerful enough to maintain the tribal system in defiance of the central government, to have his men exempted from military service and taxation, and to exact from Ahmed Zog an annual stipend in return for which he would keep his men quiet.

Each tribe in Ghegnia is an aggregation of *bairaks*. In 1929 we found 13 *bairaks* in Malsia e Madhe, 6 in Dukagin, 7 in Malsia e Jakovës, 2 in Has, 5 in Luma, 7 in Puka, 5 in Mirdita, one in Zadrina, 4 in Mati, 4 in Dibra, making 54 in all. The names of these, as recorded on our measurement blanks, are:

Malsia e Madhe: Klementi, Gruda, Hoti, Kastrati, Koplik, Greisha, Shkreli, Riola, Reçi, Loya, Postripa, Triepsh, and Kraja.

Dukagin: Shoshi, Shala, Kiri, Dushman, Pulati, Toplana.

Malsia e Jakovës: Krasniqi, Gashi, Bituç, Marina, Vunshaj, Merturi, Nakaj.

Has: Vlana, Ershan.

Luma: Biçani, Kalishi, Ujnisht, Dolovisht, Çaja (Gorë, a Serbian-speaking *bairak*, is sometimes also counted with Luma).

Puka: Kabash, Puka, Çeret, Mal i Zi, Berisha, Buxhon, Iballja.

Mirdita: Dibri, Fan, Orosh, Speç, Kushnen.

Zadrina: Zadrina.

Mati: Mat, Lura, Kthella, Selita.

Dibra: Reçi, Stashani, Sheheri Poshtar, Sheheri Fpert.

This list cannot be wrong in the cases of Puka and Mirdita, for the members of these tribes use the names *shtat bairaket* and *pes bairaket*, meaning *seven bairaks* and *five bairaks*, to designate their tribes. In Luma, Malsia e Jakovës, and Malsia e Madhe the picture is complicated by the presence of the Yugoslav-Albanian border, which not only cuts through *bairaks*, but has caused wholesale migrations and flights within the lifetimes of the subjects measured. Dozens of *fis* of a few households each have shifted about, and it is hard to tell to which *bairak* each belonged at the time the series was measured.

Miss Durham, who made her observations between 1908–13, some 20 years ahead of

⁴ Nine from Malsia e Madhe, 1 Has, 4 Mirdita, 4 Zadrina, 3 Mati, and 1 Dibra.

⁵ Three from Malsia e Madhe, 1 Malsia e Jakovës, 1 Puka, 1 Mirdita, 2 Dibra. All of these except the Mirdita man bore reserve titles.

me, found the tribal rosters different in some areas from those I later encountered. She calls Malsia e Madhe not a tribe at all, but a confederation of tribes. Of these Klementi is given 4 *bairaks*, Seltzi, Vukli, Boga, and Nikshi, while the other 9, Gruda, Hoti, Skreli (Shkrel-li), Klementi (Kilmeni), Lohe (Loya), Rechi (Reçi), Rioli (Riola), Kopliku, and Grizha (Greisha), are said to have consisted of a single *bairak* each. Triepsh and Kraja were not listed, doubtless because they lay over the Montenegrin border even before the imposition of the 1913 boundary. She did not include Postripa in the confederacy, but made it a separate group of tribes.

These were Mazreku, Drishti, Shlaku, Dushmani, and Summa. Only one of these, Dushmani, is given 2 *bairaks*, the others having one each. Dushman is the only one of these names which appears on my list, where it is given the status of a *bairak* of Dukagin. I measured in the village of Postripa itself, and am surprised that no subjects from these separate "tribes" appeared. What I was told was called Dukagin, she lists as "the Pulati group," dividing this into Upper and Lower Pulati. She grants Lower Pulati 4 small, one-*bairak* tribes: Plani, Ghoanni, Mgula, and Kiri. Upper Pulati is given Shala, with 4 *bairaks*, Thethi, Petsaj, Lothaj, and Lekaj; Shoshi, number of *bairaks* not stated; Toplana, same; Nikaj, same. Merturi, which intermarried with Nikaj and is now called part of Malsia e Jakovës, she listed with Puka as a part of Berisha. The reason for this was that "Merturi split off from Berisha eleven generations ago."⁶

Mal i Zi, listed in my roster as a *bairak* of Puka, she assigns to Luma. She makes Gashi, a *bairak* of Malsia e Jakovës, a separate tribe. She also grants tribal independence to the *bairak* of Lura, which she places at the head of a confederation including Mati and Dibra, and to Kthella, which she divides into 3 *bairaks*, Kthella, Selita, and Perlati.

It is my impression that some of these differences are due to a confusion on Miss Durham's part between *fis* and *bairak*, *bairak* and tribe. On page 68 she translates *bairaktar* as "head of the tribe." Had she not gone wrong somewhere it would have been remarkable.

Travel in Ghegnia in the years 1908-13 would not have been easy, even for an experienced man. For a woman to have made these journeys is something of a miracle. Others may be the result of the process of amalgamation, for many of the "tribes" which she mentions were miserable fragments of former populations decimated by warfare, and massacred, in some cases, by the Serbs. By 1929 a considerable realignment must have taken place in the whole area north of the Drin, and especially in the regions which she designates as Postripa and Pulati. In any case the 10 groups of people whom I have designated as tribes were so considered by the people with whom I worked in 1929, and form more or less self-contained, intermarrying units, sufficient for our present purpose.

Under the tribal system warfare was almost continuous. The underlying cause was of course population pressure. The overt causes were seduction, theft of women, elopement, cattle-stealing, and general raiding. It did not take much to give offense, particularly in the late winter, when food was scarce. Even a man who had almost enough to eat himself would be under severe tension, because of the general nervous strain of his kinsmen and dependents, and consequent maladjustment within the household.

A chance blow, a harsh word, even a play on words which is very easy in Shqip, or above all a cruel joke—these seemingly minor conflicts often led to gunplay and murder, with consequent feuding. I had several occasions to feel their Iron Age wit, so much like that of the Norse sagas. Once my host in Zadrime remarked, in front of many people, that I had the skinniest legs he had ever seen, and wondered how I could walk. The assembled company burst into Homeric roars. On another occasion, in a Puka *han*, I lifted my head suddenly and hit it a sound smack on a protruding nail, partially stunning myself in the process. This was the funniest thing in the world. Once again, when Farnsworth and I crawled into our sleeping bags for the night, the whole household laughed and laughed. When we asked what was the matter, they said, "Just think, if the house should catch on fire! You

⁶ Durham, 1928, p. 27.

wouldn't be able to get out of those sacks, Ha! Ha! Ha!"

What happens when a man kills another of the same tribe can best be learned from the following quotation from Miss Durham.⁷

Murder may be the result of a quarrel or it may be a blood-feud, the cause of which is more or less remote. In either case the man who has taken blood flies at once to a safe place outside the tribe. [Miss Durham is using "tribe" in the restricted sense, as before.] Any house is bound to give him hospitality. In the case of a feud, he is regarded as a most unfortunate man who has but done his duty. He at once proclaims his deed. The headmen of his tribe then meet and order his house to be burnt. Among the Dukagini the council has power also to destroy his crops, cut down his fruit trees, slaughter his beasts, and condemn the land to lie unworked for a term of years. An incredible amount of food-stuff is thus wasted. In this group not only the man who has taken blood, but all the males of his "house," are liable for blood, so they, too, have to fly. The "house" is the home maybe of a whole family community—forty people. But the law is carried out to the last letter. Such desolated spots have I seen. But "It is the Canon, so must be obeyed," was the answer to any remonstrance I made. The women and children may scatter and find shelter in other houses if they can; they usually do. A man can save his house if he can return to it and defend it three days successfully, so that the men sent by the council cannot set fire to it; I saw "a very brave man" in Berisha who had three times saved his house thus. Or a man can save his house by inviting the head of another mehala [household] to act as house lord and defend it with his own men. This might cause severe fighting. The council, to prevent this, then as a rule agrees to burn the house only and spare the property. The amount of property to be destroyed was always decided by the council. . . . In addition to the burning of the house, in all tribes a fine has to be paid. . . . in sheep or cattle. . . . to the Turkish Government. In the case of Maltsia e Madhe this was paid . . . in Scutari. . . . punctually The Turkish Government had a certain hold on all the nearer tribes, for it could hold as hostage any member of a tribe which owed blood-gelt and came to market at Scutari. The outlying tribes of Dukagini by no means always either notified or paid for their murders.

Feuds being very weakening to a tribe, the headmen of the tribe or friends of the family would attempt to stop the feud. Blood-feuds of the Dukagini

and Pulati tribes are settled in the mountains; those of Maltsia e Madhe were settled in Scutari before the representatives of those tribes [to the Turkish Government] who lived there.

The peace-making is preceded by the "gjaksur" (he who owes blood) sending some friends to the "zoti i gjakut" (lord of blood) to ask for "besa" (promise of truce). This may be granted and further prolonged, and during the truce the gjaksur and his relatives are safe. To end the feud . . . twenty-four con-jurors are needed to swear the peace oath with the gjaksur. The plaintiff (lord of blood) has the right to name them. Or they may be named by the "bairaktar" They examine the facts and decide if peace can be made and on what terms. If all twenty-four agree to take the peace oath with him he is then reckoned innocent, and he and his family do not owe any further blood, but pay blood gelt to the zoti i gjakut. This varied from about £25 to £50. . . .

Agreement having been come to, the whole party goes into the church (or mosque) before which the council has been held . . . and in the presence of the priest the gjaksur swears his innocence. He no longer owes blood. [After the others have all sworn] . . . the gjaksur and the zoti i gjakut frequently ratify the peace by swearing blood brotherhood. . . .

The oath being taken and the blood-gelt paid, the man is free to return to his burnt house and repair it. Being as a rule of solid stone, only the roof and wood-work need renewing. If he is a popular man, other members of the tribe help him both to pay the fine and start life again.⁸

Within the *bairak*, then, political mechanisms tended to reduce the frequency of murder by making it expensive. Murder between *bairaks* would likewise be discouraged if the central authority of the tribe were strong. Otherwise inter-*bairak* feuds could rage for decades before peacemaking. Whole tribes could likewise be in blood with each other, or with single *bairaks*, just as Mirdita was in blood with Lura during the period in which we are interested.

A central political authority tended to strengthen the ties between tribal members, and with the numerous council meetings that were called, members of the more prominent families got about frequently within their tribal boundaries. This would give them opportunity to arrange marriages some distance

⁷ Durham, 1928, pp. 66-68.

⁸ Miss Durham translated *bairaktar* as "head of the tribe." This explains her confusion between tribes and *bairaks* noted earlier.

⁹ In this whole section I have used Miss Durham's spelling of local names, now obsolete. Also, I have left the definite article before *zoti i gjakut*, where it is grammatically superfluous.

from home. The blood feud, on the other hand, scattered them even more widely, and while most of the exiles returned home, some settled outside the mountains. Miss Durham discovered around Jakova, about 1912, small villages made up of people from Fan and other

Mirdite *bairaks*, from Shala, Berisha, and other Gheg regions. Most of these exiles had probably left home involuntarily. The political framework of Gheg tribal society, particularly its warlike aspects, tends to promote emigration.

RITUAL LIFE

FORTY-TWO per cent of our series was recorded as Catholic, and the rest, except for one man,¹ as Moslem. These figures reflect the approximate proportions of the 2 faiths in Ghegnia. Their territorial distribution is shown on figure 3. All of Mirdita, all of Dukagin, about half of Malsia e Madhe, most of Zadrina, and some *bairaks* of Mati, Puka, and Malsia e Jakovës are Catholic. Catholics occupy on the whole the least accessible areas, and those closest to Rome. Moslems occupy those nearest the direction of Istanbul, along the main roads, and in the vicinity of the larger towns.

While Islam is but 4 centuries old in Albania, Catholicism has been there at least 4 times as long. During the last 12 centuries many changes have taken place in the number and location of bishoprics and parishes, and in the number of communicants. At the time of our study, there was a bishop in Zadrina, to whom the parish priests of Mirdita reported; another took care of the territory north of the Drin. Some of the priests, like Father Krasnichi whom we visited in Mirdita, were native Albanians trained in Rome, others Austrians, Germans, or Italians. All were men of physical stamina and courage, for theirs was a difficult and rigorous assignment. Some were Franciscans. In Zadrina, near the bishop's residence, was a nunnery with about a dozen inhabitants.

Many of the Moslems of northern Albania belong to an extremely heterodox brotherhood, that of the Bektashi. The tomb of the founder of the order lies in the inner recess of a long cave, really an ancient sandstone quarry, in the cliff outside the city of Cairo. His successor lives in a house at the entrance to the cave. The head of the order and all of his henchmen in residence are Albanians. The reason for this curious circumstance is that the Khedivial family of Egypt was originally Albanian, and they brought their spiritual chief, with the coffins

of his predecessors, to Cairo with them. Although for two generations the royal family has abjured the Bektashi tenets and worshipped according to Hanafi rites, the shrine and its occupants remain. Young men who wish to become dervishes go, if they are able, to Cairo,



FIG. 3. Territorial distribution of religions.

and receive their instruction at the central shrine. That is why many of the dervishes in Ghegnia spoke Arabic, and had some knowledge of other Moslem countries. Besides the village dervishes, the Bektashis have a number of monasteries, located in Has and Malsia e Jakovës. We measured the abbot of one of them, who was a Has man.

¹ Both parents came from Dibra. He was Greek Orthodox, how or why I could not discover.

Despite its centuries in Ghegnia, Catholicism has failed to change many of the customs of the mountaineers, such as the *fis* system with cross-cousin marriage, trial marriage, the levirate, blood brotherhood, and the swearing of virginity. The reason is of course that the needs which these customs fill have not been eliminated. The Moslem faith permits them and thus has become more popular. Islam is deemed the more fashionable and more civilized religion. The people of the towns, rich men, army officers, and other sophisticates are usually Moslems. Most Catholics are poor. This attitude is of course a hold-over from the period of Turkish domination. Many Albanians admired the Turks. Many spoke Turkish by preference. I recall once riding along a lane in Zadrima with my interpreter, Mr. Frasher, who reprimanded 2 old harvesters whom we passed for talking Turkish together. Bishop Fan Noli suggests that they may have been Turkish-speaking refugees from the towns of Prizren, Peia, or Podgoritza.

There is a certain dietary difference between Catholics and Moslems. The former eat pork, especially in the wintertime. The Moslems curl up their nostrils and gag at the smell of pork, and will not enter a room where it is cooking. In its place they use much mutton fat in their cooking. Catholics drink wine when they can get it; Moslems care for their alcoholic needs with *raki*. These differences are probably of no biological importance, as far as the growth and development of the individual are concerned, but they do serve to intensify the mutual antipathy of the 2 religious groups and inhibit a genetic interchange.

In Lura, in a population not exceeding a few hundred individuals, Catholics and Moslems intermarry. In a single household the father may be Catholic, the mother Moslem, and the children will choose their own religions. This is the only place in Ghegnia where this happens. Lura is in process of change from Catholicism to Islam. As the latter gains ground, mixed households are found. The government of Ahmed Zog made much of this isolated situation, urging other Albanians to follow the example of the Lurans in the interests of national unity.

Various stages in this process of shifting are found in different tribes and *bairaks*. In Mer-

turi and Nikaj, the men adopt 2 sets of names, Moslem and Christian, and employ the former while traveling to avoid trouble. They get used to these names and in many cases use them at home. In Hoti, the *bairaktar* once led his men against the invading Serbs, with the help of the Turkish government. In gratitude for his brave and successful conduct the Turks granted him special privileges, and he went over, with his family, to Islam. The rest of the *bairak* is still mostly Catholic, but the tendency in such a case is for the others to follow the leader. In Lura, where mixed families are found, the Catholics have given up keeping pigs so as not to offend the Moslems, and celebrate Moslem festivals as well as Christian ones, to avoid trouble. Very rarely a Mirdite will marry a Moslem woman from Mati, but when he does she becomes Catholic.

When the Turks introduced Islam, all Ghegs were Catholics. Almost exclusively, the change has been in the Moslem direction. Hence we may assume that almost none of the present-day Catholics bear genetic elements brought in from outside the region by the Turks or their followers, while the same is not necessarily true of the Moslem Ghegs. *Bairak* by *bairak* and tribe by tribe, as conversion progressed, the line between the 2 religions has remained, by and large, a marital barrier. During the whole period of the Turkish rule, Catholics have furthermore been able to travel much less widely than Moslems, with resultant genetic implications.

In Albania one frequently hears the remark that "the Albanians are not very religious." This is usually said with pride, for the presence of 3 religions in so small a country is deemed a dangerous impediment to political unity. In one sense, the remark is quite true. Few Albanians are religious fanatics; few of them worry about their spiritual salvation. Most of the Catholics go to church with some regularity, and most of the Moslems keep Ramadan. However, their ancient way of life provides most of the ritual which they need to tide them over emotional crises, so that church and mosque are in many ways superfluous. A man's first loyalty is to his "blood," that is, his extended family. He spends much of his time, effort, and material goods keeping the family together and avenging any deed which has up-

set its internal stability. The very act of vengeance is a ritual, as is the constant repetition of the need for vengeance. The rites of blood brotherhood and godfatherhood are rituals performed by Catholic and Moslem alike.

Both Catholics and Moslems believe in a host of malevolent spirits which pay the mountains a seasonal visit in the springtime, and which can sometimes be kept at bay by the use of amulets. These evil spirits are of course the symbols of the general hunger, illness, and irritability which beset the mountaineers at this critical season. Catholics and Moslems alike attribute non-traumatic illnesses to spells cast by magicians, through the agency of hair and nail clippings. Wasting illnesses, such as consumption and cancer, may be attributed to vampires, sucking their victim's blood.

A vampire is said to be a human being, usually but not always a woman, who can change herself into an insect and fly into a room in which her victim is sleeping. As she fills with the blood, she has to leave now and then to spit it out. A person who finds such a goblet of blood on the path is lucky; he can wrap it up and keep it as an amulet to protect him against vampires—and incidentally probably expose himself and his family to tuberculosis.

When people are hungry and ill, it is easy to suspect others of evil magic. The person named as a witch or vampire will of course be someone whose actions are eccentric or mysterious, who is a cause of disturbance in the community, and whose loss will not be greatly felt. If a child is suffering from malnutrition its parents may accuse some old woman, and drag her from her house. They will accuse her of having sucked blood from the child, and force her to spit in the child's mouth. Under protest she may spit merely in order to get away. If the child recovers, then the parents are sure she is a vampire; if the child dies she was innocent for her spittle did not cure it. People do not like being accused of witchcraft, or of having their aged grandmothers hauled off for trial; such actions, like the very suspicion itself, may result in bloodshed.

The Ghegs are great oath-swearers. Between blood feuds rivals will swear to keep the peace, on a stone in the presence of the

elders. Even if they are persuaded to swear on the cross, they will not forego the stone, which is the symbol which gives their oath validity. They are also great believers in omens, and in divination. Men versed in this skill read the future by observing the sternal bones of fowl and the scapulae of sheep. I have witnessed a performance of the latter. The bone has its special divisions, each of which has meaning. On the sheep's scapula the joint socket is the house, and its depth or shallowness indicates whether the house will be empty or full of wealth. This can be used to predict success or failure of crops. The ridge on the blade shows whether or not flocks will multiply. Small holes on the blade are cradles, and the diviner can tell how close to the family, i.e., the "house," the birth will be by the distance from the socket. When you hold the blade up to the firelight or lamp, the shape and position of the marrow will tell where and when there will be fighting. Opaque white spots mean death, and their position indicates whether they will be within or without the household of the enquirer.

All of these rituals are concerned with the maintenance of equilibrium in Gheg society. Oaths give authority to agreements, and cannot be broken until a crisis arrives which is stronger than that which the oath-breaking will produce. By clever use of the divining bones, a knowledgeable man can evaluate the state of affairs in his neighborhood, and give warnings; he can also precipitate decisions from wavering allies, for if he is a diviner of reputation, his words will be believed. Very often what he predicts will come true.

Special ritual routines common to members of both official religions restore equilibrium after the crises of birth, marriage, and death. All of these rituals which reinforce their social habits are of much greater importance to the Ghegs than the rites of church or mosque, which are not as well adjusted to this particular form of society. Another such mechanism is traditional law, codified and memorized as the Law of Lek Dukagin, which expresses the mountain attitude toward marriage and the selection of wives, and toward the blood feud. It serves to crystallize forms of behavior and inhibit change in those who are trained from childhood to believe in its infallible authority.

Still another mechanism is that of art, expressed chiefly in singing to the *oud*, or *gusle*, as it is more familiarly known to outsiders. Singing hour after hour to the accompaniment of this one-stringed instrument, and sometimes throughout the night, warriors recount the deeds of their ancestors, and even of their contemporaries. By using traditional verse forms and a stereotyped vocabulary they can compose new epics as they sing, and recite old ones verbatim. Like illiterate bards elsewhere, they have prodigious memories. *Gusle*-singing stirs the mountaineer to action as surely as bagpipe music fires the Highland Scot, thus rousing men to heroic deeds for which they may later pay dearly. It is a part of the whole com-

plex of feuding, like that other and minor art form, the embroidered and crocheted decorations on the mountaineer's clothing by which he announces defiantly from the limit of eyesight his exact familial and political affiliation.

All of these cultural mechanisms belong to Moslems and Catholics without distinction. They make up by far the greater part of the emotional life of the people, and it is no wonder that Albanians say that they are not "religious." These customs are psychological means of reinforcing the habits of behavior by which the mountain people maintain their adjustment to their environment, and as such are pertinent to our present study.

THE HISTORY OF MALSIA E GHEGNISË

HISTORY is the lifeblood of ethnography, and historians the physiologists of societies. The ethnographer's task is to describe a culture, telling where a given people live, how numerous they are, what technological means they employ to make their adjustments to the landscape, how their families are organized, what other institutions have arisen among them, for trade, for government, for foreign relations, and for the satisfaction of their ritual needs. Although his work is selective, that of the historian must be more so, for the historian is concerned with the motion of societies through time. He must select only those facts which are pertinent to his problem.

In this case our problem is to find out all we can about the origin of the Gheg people, their genetic continuity within their mountain stronghold, and the times, places of origin, and physical characteristics of any outsiders who may have breached it. Since there is, as biologists well know, a selection in migration, we would like to know when and to what extent immigrants have left this country.

These plans can only be partly consummated. History is particularly silent about refuge areas. The geographical factors which have sealed tribal Ghegnia off from the main stream of human migrations and cultural evolution have also hidden it from the eyes of chroniclers, hampering as well the work of archaeologists. Actually we know nothing about its history before the Iron Age.

Only one man, the Freiherr von Richtofen,¹ claims to have found any evidence of Pleistocene occupancy in Albania. He discovered 2 fragments of worked flint directly under a modern road bed at Mali Dajti just outside Tirana. There is no reason to believe that they were not gunflints. Pittard, in a cave near

Korça in the south, located an equally dubious Neolithic deposit.² He based his claim of Neolithic age on the shape of one pot, which could just as well have belonged to the Iron Age. Bronze Age finds have actually been made, but not within our territory. A bronze axe, found near Scutari,³ has been attributed to the late Bronze Age, and is of a type which the Phoenicians are said to have traded with the barbarous inhabitants of the Mediterranean littoral. It has a down-flaring bit and a ring-grooved haft hole, not unlike the iron axes used in the mountains today. Some of the expensive bronze tools such as that described by Vulpe may have reached the mountain tribesmen in trade, but it is unlikely that the Phoenicians themselves wandered far from the sides of their ships, or remained in this desolate region any longer than necessary.

Bronze Age sites have never been located in the highlands. This is not for lack of archaeological research, since a number of Iron Age locations have been discovered and excavated in that area.⁴ These sites consist of tumuli. Such grave-mounds have been excavated in Hoti (Malsia e Madhe), Dushmani (Malsia e Jakovës), Mirdita, and Mati. The material removed from them is of regular Hallstatt type; in fact, Menghin says that the objects from north of the Drin are identical with the type specimens from Glasinac and Dolje Dolina, type sites of the Hallstatt civilization in Bosnia.⁵

This evidence confirms that of tradition, that the Gheg country was a part of the Illyrian domain. Two other sets of facts support this conclusion still further, the facts of modern language and of modern culture.

The Gheg language as spoken today is basically Illyrian—in fact, the only survivor of

¹ Richtofen, 1939, pp. 151–52.

² Pittard, 1921, pp. 271–74.

³ Vulpe, 1932, pp. 132–45.

⁴ Menghin, 1919–20, pp. 197–202; Nopcsa, 1910, pp. [31]–[32]; Ugolini, 1927, pp. 181–88.

⁵ Dr. Robert Ehrich, who has carefully examined

the published reproductions of these objects and who is familiar with the Glasinac artifacts, states that the Albanian collections include Roman objects and others which are presumably Thracian. This evidence would set the date of the sites nearer to A.D. 1 than 500 B.C.

this once widely spoken group. G. S. Lowman⁶ says of it,

"The Albanian language constitutes a distinct branch in the Satem division of the Indo-European languages. It is the direct descendant of the ancient Illyrian of Roman times, together with some Thracian influences. . . . At the present time, two principal dialectal divisions exist, Geg or Northern, and Tosk or Southern, which are more or less mutually intelligible. . . .

"In the course of Albanian history many foreign influences have come to play their part in making the language what it is today. Although the essential structure of the language, and a fair share of the words in common use are of native origin, the vocabulary has been borrowed from outside sources to a far greater extent even than is the case of English. In 1891 Gustav Meyer stated in his etymological dictionary that of 5,140 root-words only 400 were of the original Albanian stock, that 1,420 were Romance, 540 Slavonic, 1,180 Turkish, 840 Greek, and over 700 indeterminable. Later scholars, however, have proved that a considerably larger proportion of words are truly Albanian."

Such careful observers of material culture as Nopcsa and Haberlandt have concluded that *the Ghegs*, in their tools, agricultural implements, furniture, costumes, and most other technological details *are still living in the Hallstatt Iron Age*.

A single conclusion is therefore as legitimate as it is obvious. *The mountains of Ghegnia were first effectively populated during the middle centuries of the first millennium before Christ*. The pioneers who took over this rugged landscape were Illyrians, whose central territory lay to the northwest. Since they had already lived in Bosnia and Montenegro, they were already adjusted to life in this environment.

Fortunately, the materials excavated at Glasinac,⁷ the type site of the Illyrian Hallstatt culture, include skeletons as well as artifacts. The date of this cemetery is between 1000 and 500 B.C. The collection of 38 crania shows clearly that the Illyrians were not a homogeneous people in the racial sense. The majority of the skulls are long headed, and represent at least 2 contemporary varieties of Nordic. This is not surprising since most of the Iron Age

peoples of Europe were Nordic. However, 13 crania, or one-third of the total series, were brachycephalic. These skulls have flat occiputs, straight sidewalls, broad foreheads, and in the one example in which the nasal bones have been preserved, a long and aquiline nose. They are the skulls of Dinarics, and resemble both the Bronze Age Dinaric skulls from Cyprus, and the Bell Beaker Dinaric crania from early Bronze Age sites in Germany.

All of the evidence which we have indicates that close kinsmen of the Glasinac people were the very ones who settled Ghegnia, at just about the time the cemetery was in use. We have every reason to suppose that *the ancestors of the Ghegs*, in the last 500 years before the Christian era, their pioneer period, *were very much like the people whose remains were buried in the graveyard at Glasinac*. This means that among the Ghegs, characteristic Dinarics were present from the beginning, but probably as a minority in the population.

Let us return for a moment to the statement that the Ghegs are still living in the Hallstatt Iron Age. This means that no important changes have taken place in their technological processes. If the Illyrians had just as good equipment for tilling the soil, processing food-stuffs, building houses, weaving cloth, etc., as the modern Mountain Ghegs, then they were able to exploit the landscape just as efficiently as their modern descendants. The valleys and upland pastures of Ghegnia could thus have held as large a population then as today.

This assumption cannot be made without a certain amount of correction. The modern Ghegs grind their flour and full their cloth in mills operated by water power. This releases a certain amount of human energy for other pursuits. These mills must have been introduced after the initial settlement. Warfare, which is a characteristic mechanism of population control in upland Ghegnia, has also undergone changes. The Turks introduced both firearms and the *kulla*, or stone castle (fig. 8, a), weapons of offense and defense. This combination made murder easier than before, and must have helped reduce the population. On the whole, the forces for increased use of

⁶ Lowman, 1932, p. 271.

⁷ Weisbach, 1897a, pp. 80-85 and 1897b, pp. 562-76; Coon, 1939, pp. 184-85.

the land and decrease of manpower probably counterbalanced each other.

It must have taken several centuries for the pioneers to explore every valley, choose the most favorable sites, and put them into cultivation. In a few centuries more, less favorable lands which could support a thinner population would also have been cleared. But by the beginning of the Christian era, the time when the first outside influence, that of Rome, made itself felt on the fringes of the Gheg mountains, this region may well have been populated to its present capacity. This means that there was no room for Romans or anyone else to settle without armed invasion. Even with armed invasion, as many have discovered, the Gheg mountains are hard to take.

Biologically the significance of this is of course that while the original settlers of our area must have been a mixed lot, they were probably able to fill their country with progeny before any concerted attempts were made by outsiders to invade their territory. The majority of them were undoubtedly Illyrians from Bosnia, while others may have been Thracians from the plains to the northeast. Racially they were probably a mixture of Nordics, Mediterraneans from the Adriatic littoral, brachycephals from the same region, and Pontic Mediterraneans from the Euxine borderlands. They were able to stew in their own genetic juice and produce their own variety of human beings.

Roman authors have much to say about the peoples all around Ghegnia, but very little about the mountaineers themselves. This silence is very significant. All of Ghegnia except for the southern portions of Mati and Dibra formed a part of the province of Dalmatia, while those 2 sections of tribes plus what is now central Albania went with Macedonia. The present Tosk country was part of Epirus, which was considered distinct from Greece. While the predecessors of the Tosks

were Epirotes and those of the Ghegs Illyrians, the people in between were formed by a mixture of these 2 elements. Strabo, in Book Seven, enumerates the central Albanian tribes which were subdued by the Macedonians, and some of whom spoke 2 languages. He says that some of the tribes were constantly seeking to gain control over others, but that the Macedonians put an end to this rivalry. In 168 B.C. Macedonia became a Roman province. That the central Albanian tribes resembled the modern Ghegs in some respects is certified by their use of the word *peligo* (*plak*) for elder, the tribal name Emathia (*e Madhia*, the Great, nominative plural), and possibly the tribal name Molotti (*maltso*, *mountaineer*).⁸

Strabo locates a people known as the Dardanians to the northeast of the Gheg country, on the Kossovo plain, beyond the upper reaches of the river Drin.⁹ Strabo considered the Dardanians an utterly savage people, living in pits under dunghills and playing stringed instruments. Despite this cultural abasement, they furnished Rome with an emperor—Justinian. The country of the Dardanians, which the Romans conquered, was said to be heavily forested up to the neighborhood of Nissa, the modern Niš, an important crossroads town in Roman times as today. Peter the Hermit, who led a crusade through this country at the end of the 11th century (A.D. 1095–1121), walked 7 days through this forest, and finally reached Niš, which he found to be defended by stone walls, and to have 7 water-powered gristmills. In 1717 a British traveler (Lady Mary Wortley Montagu) found the forest still there, and infested with gangs of bandits.¹⁰ In 1809 much of this forest was still left when the Serbian peasants revolted against the Turks, led by Karageorge. All of this means that as long as the plain of Old Serbia was forested, there was room in it for people to expand. It was not a center of population from which large migrations could be initiated.

⁸ Durham, 1928, p. 14.

⁹ Strabonis Geographia, Book 7, p. 457, lines 3–6: “. . . et Drilo fluvius, quo adverso navigatur orientem versus usque ad Dardaniam.”

or

καὶ Δρίλων ποταμὸς ἀνὰ πλὴν ἔχων πρὸς ἑω, μέχρι τῆς Δαρδανικῆς.

I give this in both original tongues because it is a somewhat difficult passage to translate and because Miss Durham misunderstood it, placing the Dardanians in Albania.

¹⁰ Durham, 1928, pp. 232–34.

The evidence is excellent that in Roman times the geographical division of labor, by means of which the mountaineers exchanged their raw materials for processed goods in bordering market towns, had already begun. Since the earliest archaeological material in Albanian sites is either of Bosnian, Thracian, or Roman manufacture, this system must have been in force from the beginning of the Illyrian settlement. On the Adriatic side of the mountains small Roman trading posts have been located archaeologically at Berzunno (Vuksanlekaj, north of Scutari), Cinna (Koplik), and Iminacum (Iballja, in Puka).¹¹ The Romans also occupied Scutari (Scodra), Lesh (Lissus), and Durazzo (Dyrachium), and connected these 3 market towns with a road.

At Durazzo this road turned eastward from the coast and went across country, following the lowest gap in the Dinaric chain north of the Gulf of Corinth, over to Lychnidus on Lake Ochrida. This highway skirted but did not traverse the Gheg mountains, crossing the Black Drin just south of the present tribal boundary of Dibra.

Another road, however, went straight across the mountains from Lissus (Lesh) south of the Drin.¹² It apparently followed the same course as the modern road which goes from Vau i Denjës in Zadrina to Puka, across the Mal i Zi and down to the bank of the Black Drin just a short distance south of its confluence with the White Drin. This road follows the south bank of the White Drin for about 18 miles, at which point the river makes a sharp bend to the north.

In Roman times the country beyond the confluence of the 2 Drins was part of the province of Upper Moesia. The road continued across this province to a place called Ulpiana in the Kossovo plain, probably near the modern town of Prishtina. From Ulpiana it went on to the Morava valley where it reached the river at Nissa, the modern city of Niš. This road was not the only Roman highway which crossed the Dinaric Alps from the Adriatic into the modern city of Niš. It was only one of 3 methods of getting from the Adriatic coast to the Danube valley over-

land. Far to the north, a highway connected Senia (Zengg) just south of Fiume, with Siscia (Zagreb or nearby) and the route down the Save. From Spalatum (Split) too it was possible to cross the watershed on Roman pavement. The *Via Ignatia*, across central Albania, offered a longer route to Niš, for at Heraclium (Bitolj) it met at right angles a road going north and south, one branch of which passed, via Scupi (Skoplje), to Ulpiana.

The Drin road cannot have been the most comfortable of these various routes. Although the Romans must have kept it in repair, there is little evidence of it left today. It can never have been suitable for wheeled traffic, for it is narrow, twisting, and steep, consisting in places of steps, hewn in the rock or built of masonry. For 2 nights the travelers must have slept in Gheg mountain territory. This means that the Romans must have built fortified stations for this purpose. The first night would take them to Picaria (Çeret?), the second to Creveni, near either the present Spash or Parmchi, on the south bank of the Drin a few miles below the confluence. The third night would take them out on the plain, on the way to Ulpiana. A Roman settlement at Gabuleum, somewhere near Gonaj or Zum in present-day Has territory, may have been the spot.

The transport of goods over this road, with processed materials moving east and raw materials west, must have furnished a strong temptation to the mountaineers on either side. The Romans must have kept it guarded, for otherwise ambushes would have been easy. Garrisons mean troops, and troops mean fraternization between imported soldiery and the local population. Perhaps many of the soldiers were recruited from Gheg tribes a short distance from their posts. Even so, some must have been outsiders, and we may expect that the genetic capsule of Ghegnia became somewhat unsealed during Roman times along the highway. This would affect principally the tribe of Puka, across which much of the road passes, and also the tribes of Luma and Has, which it skirts.

After the decay of the Western Empire the

¹¹ Nopesa, 1910, p. [31].

¹² Shepherd, 1921, map 39; Kiepert, 1894, map XVII, Illyricum et Thracia.

road must have been much less patronized, for there was no one either to keep it up or guard it. Furthermore, what goods would come out of Moesia and Dacia would go to Byzantium rather than to Rome. In the 4th and 5th centuries A.D., the Goths over-ran parts of eastern Ghegnia, and traditions about them remain in the tribe of Luma, where some of these northerners may have settled. In A.D. 535, Justinian defeated them and claimed Ghegnia for the Eastern Empire.

It was probably just at the period when the traffic over the Puka road was at its height, about the 4th century of the Christian era, that the tribesmen on either side of it may have been first converted to Christianity. Constantine himself, the first Christian emperor, may have passed through Ghegnia, for he was a Dardanian, a native of Niš. Our first record of Christian establishments in the mountains is dated A.D. 877¹³ when there was already a bishop at Pulati, and by the 14th century we hear of 2 bishoprics, Pulatenses Majores and Pulatenses Minores, which were united in 1520. Another bishopric had its seat in the village of Drivasto (Drishti), in Postripa.¹⁴

Early in the 6th century the southern Slavs invaded the Balkans. A century later some of them moved westward from the Plain of Kossovo through the Drin Gates into Gheg territory, probably following the old Roman road. Their arrival at the Adriatic is still memorialized by the Slavic name of the tribe Zadrima, and a number of other place names. For 700 years the Serbian kings maintained a nominal rule over this mountain country. Now and then they disturbed the Catholic Albanian population, as in 1335, when the Tzar Dushan gave to the Orthodox monastery of Dechani¹⁵ the land of the village of Summa, on the right bank of the Kiri in the Pulati bishopric, along with neighboring Albanian districts, and a number of bondsmen whose names read very much like those on our measurement blanks. Between 1372 and 1427, "Helena, widow of Stefan Dushan, and her son, Urosh [sic], 'vexed most bitterly the Catholics, and spoiled

them of their goods, and reduced them to extreme poverty.'"¹⁶

During the Slavic period it is likely that the invaders had some effect upon the genetic composition of the mountain people, for Slavic names, such as Orosh, are common enough in Ghegnia, the Slavs certainly had access to much of the country, and Slavic speech had a considerable effect on the Albanian vocabulary. This was not, however, as important an invasion from the standpoint of biological interest as others that followed.

During the brief period between the end of the Old Serbian Empire and the time of the Turks, the Ghegs were left alone. The Turks began their invasion of Albania at the end of the 14th century, after the battle of Kossovo, in 1389. They met in battle the formidable Scanderbeg¹⁷ (George Castrioti), the most famous of all Ghegs. He and his successors held them off from his fortress at Kruja (or Croya) until after 1479, the date of the fall of Scutari. The Turks never won control of all the highlands. Indeed, all of Mirdita and Dukagin, and parts of other tribes, remained Catholic throughout the Turkish period. Remaining Catholic meant that they were able to keep their country free of Turks. It also meant that they usually stayed at home. However, many of the Christians adopted Moslem names which they used when they left their tribal territory to visit market towns, and this custom was still going on in 1929.

All of the Ghegs who were converted to Islam did not change their faith through necessity. Many of them saw solid advantages in making the shift. A Moslem could carry a gun openly anywhere, and could shoot Christians at will, for they were outlaws. He could travel in Turkish territory without having to worry about being caught, and he could obtain many economic advantages over his Christian relatives, whose marital arrangements, unlike his own, produced a religious conflict. He could join the Turkish army, and rise to high rank; many Turkish generals were Albanians. Other Albanians became high court officials. One of

¹³ Durham, 1928, pp. 24-25, 28.

¹⁴ Farlati, 1817, pp. ix-xiv, tells the story of these Albanian Bishoprics; see also Sufflay, 1916, p. 188.

¹⁵ Durham, 1928, p. 29.

¹⁶ Durham, 1928, pp. 24-25

¹⁷ See Fan Noli, 1947.

them founded the royal house of present-day Egypt. The Turks appreciated their Albanian subjects and favored them over many others. That is one reason why three-fourths of Albanians are still Moslem, and why Albania remained so long a part of the Turkish Empire.

Although the Turks probably did not add much genetically to the Gheg population, they did introduce some economic changes which may have had some effect on it. It was through the Turks that New World plants reached the Balkans, although in some places not before 1850. They added maize, haricot beans, and tobacco to the list of plants which would grow in the valleys and on the mountain slopes. Maize and haricot beans gave them new foodstuffs, but it is questionable if they yield more calories per acre than the earlier crops—small grains and broad-beans. Tobacco gave the mountaineers a new habit and a new need, and also a cash crop. On the debit side of the ledger, with their religion the Turks produced a prohibition against pork, and deprived their converts of an important food source.

Besides these agricultural and dietary changes the Turks introduced *hans*, or inns, along the more traveled roads in Moslem territory. Some of these *hans* probably occupy the same locations as Roman hostels. The professions of *hanji* (innkeeper), and *kiraji* (renter of horses) seem to have been Turkish innovations. In Turkish times, many Albanians migrated to other countries; tens of thousands went to the Plain of Kossovo, apparently from the Gheg country, and many others to Greece, where there are still Albanian-speaking districts in Attica and the Peloponnesus. Many thousands entered the Turkish army, and other government services. Meanwhile, tens of thousands of Christian Albanians, fleeing the Turks, settled in Italy and Sicily, where their descendants still maintain their ethnic identity.

Probably the most important single introduction of the Turks, however, was firearms. Gunsmiths in the market towns found the mountaineers eager to obtain the new weapons with which they could not only defend their home valleys from invaders, but also work off

their local grudges. Silversmiths did a heavy business converting coin into ornaments for pistols and ball-boxes, ornate holster belts, and powder-horns. Feuding now became much easier and more lethal. After firearms, arrived the *kulla*, or stone castle. Although this new house type offered some defense, it did not prevent the great loss of life that the new weapon had initiated.

Now that the Ghegs were divided into 2 religious groups, and had guns, the death rate must have increased. The Turks themselves accounted for some of the population loss. They destroyed all the towns of north Albania from Durazzo to Scutari,¹⁸ and others in the mountains as well. For example, they dragged the leading men of the town of Drishti in Postripa, the seat of an early bishopric, to Scutari, where they beheaded them.¹⁹

Massacre and emigration reduced the population of certain sections of Ghegnia below the economic maximum for the first time since its settlement in the Hallstatt Iron Age, thus opening the way to new immigrants. These were Christian tribesmen from Bosnia and Herzegovina, squeezed out by the Turkish expansion, and particularly by the struggles between Turks and Slavs. They were neither Turkish nor Slavic, but the remnants of the pre-Slavic population, still speaking a latinized form of Illyrian, and Catholic. In speech and religion, they found themselves at home in Ghegnia.

Most of them arrived during the 16th century. In the *bairak* of Gruda, Miss Durham found 500 houses, 80 of old indigenous stock, tracing their ancestry to Berisha (Puka), while the other 420 were inhabited by people who claimed descent in the male line from immigrants, called Djell, who came down from Herzegovina about A.D. 1530. A few years later, at least 4 brothers entered the Malsia e Madhe country from Bosnia; they were Geg Laz, ancestor of the Piperi tribe in Montenegro, which is now Slavic in speech and Orthodox in religion; Vaso Laz, the ancestor of the similar tribe of Vasojevitch; Krasni Laz, ancestor of the *bairak* of Krasniqi in Malsia e Jakovës—most of whom are now Moslem, although a few are Catholics. Nik, the ancestor

¹⁸ See Jireček, 1916, pp. 63–93.

¹⁹ Durham, 1928, p. 28.

of Nikaj, may have been either a fifth brother or a son of Krasni Laz.

The people of Shkreli, comprising a whole *bairak*, are said to have come from Bosnia en masse about 1600, and taken over a valley whose inhabitants had been killed off and whose church, Shen Kerli (St. Charles, hence Shkreli) destroyed. Three hundred out of 500 houses in Kastrati are said to be descended from a man called Delti, who came from the Kuchi region of Montenegro, with his 7 sons. He was, however, reputed to have been descended from Berisha, the oldest known *fis* in Albania. The 4 *bairaks* of Seltze, Vukli, Boga, and Nikshi in Klementi trace their descent from 4 sons of a man called Klimenti who fled from the neighborhood of Gusinje about A.D. 1600.

All of the inhabitants of Malsia e Madhe do not claim descent from these invading ancestors. Their traditions are so consistent, their genealogies so clear, that we cannot doubt that these invasions took place, or that earlier populations survived. In Gruda, 80 houses belonged to the Berisha *fis*, while in Hoti a small number of *anas*, or aborigines, remained. The newcomers intermarried with them. The descendants of these 2 population elements still intermarry regularly. Two hundred out of the 500 houses of Kastrati are pre-invasion, and are said to be of Slavic origin. Reçi includes a few houses of *anas*. The rest of the population, like Loya, claims as its ancestors refugees from Shlaku and Pulati. All in all, Malsia e Madhe seems to have borne the brunt of this Bosniak invasion, and to have derived from it a large part of its genetic composition (fig. 12, c).

In other parts of Ghegnia we find less evidence of invasion. The Berisha *fis* has been traced back certainly to 1370, probably to A.D. 1270. If it is that old, it may well go back to the pre-Roman period. Merturi split off from Berisha about A.D. 1700. The 2 *bairaks* of Dushman, Temali and Dushmani, are known since 1402, when they appear in written records as allies of Venice. They are probably much older. The people of Drishti, whose predecessors were destroyed by the

Turks, came from different places. The people of Toplana were driven to their present mountain stronghold from Vasojevitch in Montenegro about 1450, being pushed out by immigrants from Herzegovina. The ancestors of Plani came from 3 sources: Klementi, Merturi, and indigenous *anas*. Those of Kiri were from Kuchi and Ipek, in Montenegro. One hundred houses of Nikaj people are said to be descended from a daughter of Nikol by a gypsy, and are called Tsura. This is the only instance known of female descent, and indicates the relative social status of the alleged spouses.

The famous invasion of the Dukagin brothers, Shosh, Shal, Orosh, Spaç, and Kushnen, probably took place before the Bosniak migration.²⁰ Miss Durham derives them from the Pestriku mountains near Jakova, where they were part of the Ipek tribal confederacy. My informants named Marina *bairak* as their home. In Shala they are supposed to have found some small, dark people with whom they intermarried. A few of these *anas* stayed on, and there are said to be 8 houses of them at Abate in Lower Shala, while the rest immigrated to Dechani. The Mirdita brethren found the Dibri and Fan people ahead of them.

One tradition relates that the Dukagin *bairaks* of Mirdita did not stay long in their new home, but when the Turks had taken Scutari and were raiding the neighboring mountains, the settlers retreated to their ancient home, from which they did not return to Mirdita until around 1650. How true this is, and how many people, if any, it involved, cannot be determined.

We know finally that Jakova town was settled by people from various parts of the Gheg mountains, and the same is true of Ipek. These were cities of refuge, like earlier towns before them. More recent than any of these is the village of Vraka, a community of a thousand people lying between Koplik and Scutari. This is the residence of Serbian-speaking, Orthodox farmers, whose ancestors fled from blood vengeance in various parts of Montenegro, Herzegovina, and Bosnia. They have not yet become absorbed, and with modern

²⁰ The Dukagins are centuries older. See Gegaj, 1937, cited in Fan Noli, 1947.

politics what they are, probably will not be. They serve our purpose of illustrating a principle of population movement in a feuding society.

This ends our history up to the final date of the ethnographic present as defined in chapter I, "The Dinaric Problem."

Turkish rule lasted in Albania until 1912. After the Balkan wars an opera bouffe kingdom was set up with the Prince of Wied as king, and the capital in Durazzo. During his uninspired reign an international boundary commission laid out the borders of the new state, and at every point where there was any question, Albania came out the loser. Gruda was given to Montenegro. The Grudans who survived this political change fled to Scutari. Hoti lost part of its land, particularly its winter pasture. The tribesmen of Klementi were so cut off that they could not drive their flocks to their winter pasture near Scutari without crossing Montenegrin territory, which would have been equivalent to losing their animals. The Serbs closed the border to mountaineers bringing their goods to Jakova to trade, and expelled many of the Albanians from both that city and Ipek. They made it almost impossible to travel between Kukës and Prizren; in 1929 our party was held up a whole day while we were searched to the skin, ordered to read aloud all of our papers, accused of being renegade Croats, etc., and we finally got away only after a great deal of telephoning on the plea that one of us was dangerously ill. In Prizren we found the jail full of Albanians.

Dibra as well was lost as a market town. Kukës sprang up as a makeshift metropolis, as did Peshkopia. Tradesmen and artisans, as we have seen, stole over the border from Jakova, Prizren, and Dibra, to set up shop in the new places. The boundary commission could have created no more international hatred if this had been its principal objective.

World War I followed immediately after these unwise decisions, and the powderpuff king ran away. An army of Serbs, fleeing for their lives, marched across Dibra and Mati, burning and looting as they passed, to seek refuge on Corfu. Austrian troops, at their heels, occupied Scutari and the Malsia e Madhe, as well as the region of Kukës. They built

a few roads and bridges, and found time to do some anthropometry.

After the war Albania became a republic, with a parliament. Feudal and tribal, illiterate and immobilized by the lack of roads, the people were not prepared for self-government. After a number of violent episodes Ahmed Zog, son of the *bairaktar* of Mat in the tribe of Mati, became dictator, and in 1929 proclaimed himself king. Hated by the people of Elbasan because he had jilted the daughter of Verlatsi, their most prominent citizen, he was despised by his fellow mountaineers and by the Tosks as well, most of whom saw in his rule a threat to their freedom. On the rare occasions when he dared leave his palace, he had all roofs and windows searched and guarded, and even the cypress trees searched; and then he sent a double ahead of him.

He did, however, make a number of wise moves. One was to employ Colonel Stirling, famed as a companion of Lawrence in Arabia, as his personal adviser. Another was to employ General von Mirdach of the Austrian army to set up his military machine. A third was to give the British General Percy a free hand in organizing a gendarmerie. General Percy brought with him a staff of British officers, which included Colonel Martin and Major Glegg. These experienced men selected an elite group of mountaineers to police the highroads, and to report and put down trouble. For the first time in history someone was taking intelligent steps to rid the mountains of feuding.

We measured 62 of these gendarmes, all local men. Twenty-one came from Luma, 17 from Mati, 10 from Puka, 6 from Malsia e Jakovës, 4 from Dibra, 3 from Dukagin, and one from Malsia e Madhe. The British officers very wisely used Ghegs in Gheg country. To have introduced outsiders would have made trouble. Many of the men were serving within their own tribes and *bairaks*; too often they were in blood elsewhere. This new occupation for mountaineers gave them a chance to see more of the world than before, for they were required to train in Tirana or Scutari. Although the gendarme system made little or no direct change in the genetics of the mountaineers, for these men marry as their fathers

did, it let in new traders, craftsmen, and government officials, by the mere fact that the gendarmes secured the road and put down banditry.

In a vain attempt to deal the tribal system a deathblow, King Zog abolished all of the old divisions and boundaries, and all of the old system of government. He divided Albania into provinces, deliberately cutting across tribes and *bairaks* and ignoring natural geographical frontiers as completely as did the 1913 boundary commission. Kukës and Peshkopia became centers of administration, as did a remote hamlet in Mati named Bureli. In these new places he set up prefects and secretaries and soldiers.

We measured one "secretary of commune" in Mirdita, whom the tribesmen ignored. He was a native of Elbasan. He employed a local man to guard the telephone line, his only link with the extra-feudal world. In Bureli we measured a secretary of court and a schoolteacher, both Mati natives. Others whom we did not measure were outsiders. In Kukës we measured a government clerk, a schoolteacher, and a turnkey in the jail. In Peshkopia our score was 3 government clerks, 2 Big Dibra men and one local; a secretary of court, from Big Dibra; and a local country schoolteacher.

These 7 civil service employees whom we included in our series were all the products of the imposition of Zog's government on the Mountain Ghegs. Of these only 4 came from outside the area. Three of these were part of the group that fled Big Dibra after 1913.

The history of the mountain people of northern Albania since 1930, while interesting, is beyond the scope of this report. Some later anthropologist may study it with profit to discover the changes, technological, institutional, and anatomical, which may have taken place since our series was measured. Before moving on, we offer the following summary of the preceding chapters:

1. As far as we know these mountains were uninhabited before 500 B.C. They were first effectively settled at this time or a little later by Illyrian-speaking Hallstatt Iron Age people moving southward and eastward from Bosnia.

2. The majority of the Hallstatt people in

Bosnia were Nordic in cranial type. A minority consisted of planoccipital brachycephals.

3. The mountaineers have retained the core of their ancient language and the essential features of their original culture—in technology and social behavior—into the time period covered by our study.

4. From Roman times onward they have lived by a typically Iron Age regional and ethnic division of labor. The mountaineers farm and tend their herds, and exchange their raw and home-processed surplus materials with townsmen along their borders, receiving in exchange processed goods and skilled services.

5. The Romans introduced Christianity, which had little if any effect on their way of life. If anything it fortified their exogamic system of mating.

6. The mountains have been overpopulated since almost the first settlement. This has caused feuding and emigration. Many have left the mountains to settle elsewhere, few have entered.

7. At several periods outside peoples have seized control over the Drin highway and, to varying degrees of effectiveness, its more accessible side valleys. The Romans built the road, and Slavs and Turks followed them over it.

8. The Turks massacred many Ghegs in the Malsia e Madhe country. The wholly and partly empty villages were repopulated by immigrants from Bosnia. These were Catholic tribesmen, who spoke the parent language, Illyrian, in a semi-Romanized form. It differed little from the speech of the Ghegs themselves. These people were, in fact, a reinforcement from the earlier Gheg homeland, thrust out by the pressure of Slavs and Turks. They were a second wave of migration.

9. The Turks introduced firearms and fortified castles (*kullas*), thus increasing the tempo of feuding.

10. They also converted many of the mountaineers to Islam. This meant that Moslem Ghegs could circulate freely in other parts of the Ottoman Empire. In some of the Moslem areas the Gheg system of mating has become less strongly exogamic.

11. From the standpoint of theoretical genet-

ics, the Mountain Gheg population forms a (for Europeans) peculiarly closed breeding unit, within which mating proceeds along known rules. Except for the Bosnian invasion a dozen generations before the date of our sample, no new genetic elements of numerical importance can have been added since the first Iron Age settlement.

12. The Bosnians, who were derived from the same population as the earlier Gheg im-

migrants, settled north of the Drin, mostly in Malsia e Madhe. Their descendants have, by and large, remained there.

13. The tribal Ghegs grow their own food, village by village, and eat almost exclusively local products. Since their country varies greatly in geological base material, this series offers a splendid chance to study local growth differences in relation to differences in mineral soil content.

ETHNIC COMPOSITION OF OUR METRICAL SERIES

THE number of men whom we measured in Ghegnia depended on how widely we could travel, how much time we had, and how long it took to measure each man once we had persuaded the local people to submit to this nonsense. Before we had gone far we decided that 100 men per tribe was about our limit. This number is large enough to serve as a statistical sample, and it was about as many men as we could get to submit in each area without wearing out our welcome. Whenever we measured a man defective in some criterion, as, for example, with a bent back, or edentulous jaws, we counted him as one over the 100. Thus, in every criterion we could have a total of 100 or more. In Has, our series is larger, because on the last day more men appeared than we had expected and we could not stop measuring without giving offense.

We avoided measuring soldiers when we could, because they had been selected for stature. Only a few who were home on leave were included in our series. We also avoided measuring in cities, preferring to study our subjects in their native places. Thus we could be sure of what we were getting. One exception was made. In Scutari we measured the members of *bairaks* fugitive from Montenegro, particularly Gruda. Otherwise we would not have had them. Elsewhere measuring became somewhat of a ritual. The elders were usually present, and they would dictate the protocol. They would also hear what the younger men said about their family histories, and more than once corrections were made on the intervention of these elderly mentors. Only when they tried, once or twice, to have the tallest and strongest men measured first, was it necessary to interfere with their arrangements. In Kukës we measured in a restaurant. There our agents, soldiers and gendarmes, lured men in off the street, and our check on their provenience and relationships left something to be desired, as will shortly appear.

The composition of our tribal samples appears in detail in table 2. As the reader can

see, we tried to distribute our sample equably among the *bairaks*, with varying degrees of success. Klementi, which has 5 *fis*, produced 4 of our subjects by internal mating. The 3 apparently endogamous Gruda products reflect the mating of the 2 *fis*, Berisha and Djell, discovered by Miss Durham. The Hoti-Hoti man may have had a mother from the *anas*; the Kastrati-Kastrati man reflects the presence of 2 *fis*. Koplik and Greisha, being almost entirely Moslem, form what is virtually a unit. Shkreli, Riola, Reçi, and Loya are mostly exogamous, while Postripa subjects were derived from local parents only. On the whole Malsia e Madhe forms an interbreeding population with little tendency for local marriages, except among the lacustrine *bairaks* of Koplik and Greisha, and in Postripa. Postripa should have been given separate treatment, as Miss Durham's evidence indicates, but it is now too late.

In Dukagin we measured at only one place, the hill of St. George on the boundary between Shoshi and Shala. Both Shoshi and Shala were partially endogamous, Shala predominantly so. This reflects the presence of *ana* households, and splits into 2 *fis* each. Toplana, Kiri, Dushman, and Pulati, all parts of the Lower Pulati group, are represented only on the maternal side. Since these people habitually marry across the river into the northern *bairaks* of Puka, we decided to concentrate on the Dukagin element in the tribe of that name. As in the case of Postripa, I feel that this was a mistake.

The sample for Malsia e Jakovës shows a more equable distribution. If Nikaj men were slighted, the mothers of all Merturi men may compensate. These 2 *bairaks*, being *fis*, intermarry habitually. In Has we did not discover that a second and very small *bairak*, Ershan, existed until our series was complete. In Luma we could not determine the *bairaks* of 8 men, all of whom said that their fathers and mothers came from a single place. Perhaps they were joking and making up silly names. That is one of the tribulations the physical anthropologist

has to face in the field. Half the Luma sample came from Biçani, which comprises over half the tribe. As one can readily see, these Moslems marry within their own *bairaks* most commonly.

In Puka it is manifest that Kabash and Çeret form each a single *fis*. Berisha, the oldest known *fis* in Ghegnia, has a companion *fis*, Thach, in its *bairak*, with which it sometimes marries. Buxhon and Iballja each have more than one *fis*, as do Puka and Mal i Zi. On the whole the *bairaks* of Puka, whether single or multiple as regards *fis*, are exogamous. Since marriage across the Drin is frequent, many of the men from Buxhon, Berisha, and Iballja may have had mothers from the Lower Pulati section of Dukagin.

We were able to get a complete list of the *fis* in the tribe of Puka, except for Mal i Zi, as follows:

1. *Kabash*, *bairak* and *fis*. Three hundred houses, located in Kabash, Puka, and Iballja.
2. *Marin*, a *fis* of 30 houses in Puka village of Puka *bairak*.
3. *Guian*, a *fis* of 3 or 4 houses only, in Puka village.
4. *Kashnet*, 20 houses, Puka *bairak* only.
5. *Shkrella*, 20 houses, Puka *bairak*, related to the Shkrelli people in Malsia e Madhe.
6. *Krasniq*, with obvious affiliations, 10 houses, Puka village.
7. *Shala*, with obvious affiliations, 60 houses, Puka *bairak*.
8. *Thach*, this is the only *fis* in Buxhon, and one of two in Kabash, the other being Kabash *fis*.
9. *Berisha*, *bairak* and *fis*, a single unit.
10. *Kcheira*, a *fis* in Çeret.
11. *Shosh*, with obvious affiliations, a *fis* in Çeret.
12. *Çereti*, also a *fis* in Çeret.

In Mal i Zi there are said to be many other *fis* besides these 12. The above list shows 7 different *fis* in the single *bairak* of Puka, with 3 of them limited to a single village. This situation reflects the location of Puka village

at a natural stopping point on the Roman road, where other trails come in. It is also a trading center, and one of administration. Its geographical position has brought in people from many places, and it stands in striking contrast to the more isolated *bairaks* of the same tribe, which in some cases have only one *fis* each. If Mal i Zi has many *fis* as well, that is because it too is conveniently located on the road.

In Mirdita exactly the opposite situation is found; the 3 *bairaks* of Orosh, Spaç, and Kushnen all belong to one *fis*, although one village in Orosh is eligible for marriage with these Dukagini. This village was once part of Kthella. Two of our subjects were the sons of women from this village. Fan and Dibri marry both with Dukagini and within their own *fis*, of which there are several.¹ In our series Kushneni married only Dibri, which was nearest; Fan mostly Orosh, for the same reason. One blank bears the astounding information that its subject was the son of an Orosh father and a Kushnen mother. This is undoubtedly some kind of a mistake, possibly similar to the situation noted above.

Zadrime is only one *bairak*, all Catholic except a few small villages nearest Scutari. Despite its lowland habitat it retains its tribal organization, as well as its Gheg speech, and hence was included in this series. We did not obtain a record of its *fis*.

All 4 *bairaks* of Mati contain 2 or more *fis* each. The 3-part Catholic *bairaks* in the north form an intermarrying group and married with Mirdita extensively in the old days. In the time of our series, Lura was in blood with the Mirdites and the exchange of wives had been broken off. Very rarely do these northerners intermarry with the men of Mat. If this job were to be done again, the 3 northern *bairaks* should be given separate consideration for they are a genetic unit apart from Mat. The northerners are frequently tall, the Mat men almost uniformly short. In Dibra the 4 *bairaks* were almost wholly endogamous, and again separate treatment would be profitable. If we had measured 600 more men, the series would have been a better one.

¹ Kashnet and Guian of Puka also appear here. Vik, Mesouli, seem to be others.

TABLE 2: COMPOSITION OF TRIBAL SAMPLES.

FATHER	MOTHER	No.	RELIGION	NOTES	FATHER	MOTHER	No.	RELIGION	NOTES
<i>Malsia e Madhe</i>									
Klementi	Klementi	4	Catholic	2 Vukli, 1 Nic Klenend	Reçi	Reçi	1	Moslem	
Klementi	Shkreli	2	Catholic		Reçi	Kastrati	1	Moslem	
Gruda	Gruda	3	Catholic		Reçi	Kastrati	1	Catholic	
Gruda	Hoti	1	Catholic		Reçi	Riola	2	Moslem	
Gruda	Kuçi	2	Catholic						
Gruda	Triepsh	1	Catholic		Loya	Klementi	1	Catholic	
Hoti	Hoti	1	Moslem		Loya	Kastrati	2	Catholic	
Hoti	Klementi	1	Catholic		Loya	Hoti	2	Catholic	
Hoti	Kastrati	3	Catholic		Loya	Shkreli	2	Catholic	
Hoti	Gruda	3	Catholic		Loya	Riola	2	Catholic	
Hoti	Triepsh	5	Catholic		Loya	Reçi	3	Moslem	
					Loya	Postripa	1	Moslem	
					Postripa	Postripa	10	Moslem	
Kastrati	Kastrati	1	Moslem		Total				
Kastrati	Hoti	6	Catholic				105	53 Catholics, 52 Moslems	
Kastrati	Gruda	2	Catholic						
<i>Malsia e Madhe, summary</i>									
Koplik	Koplik	8	Moslem		Bairak	FATHER ONLY	MOTHER ONLY	BOTH	TOTAL, BOTH OR EITHER
Koplik	Greisha	2	Moslem		Klementi	2	5	4	11
Koplik	Kraja (Yugo)	1	Moslem		Gruda	4	5	3	12
Koplik	Kastrati	1	Catholic		Hoti	12	9	1	22
Greisha	Greisha	1	Moslem		Kastrati	8	11	1	20
Greisha	Riola	1	Moslem		Koplik	4	8	8	20
Greisha	Koplik	6	Moslem		Greisha	7	5	1	13
Shkreli	Shkreli	3	Catholic		Shkreli	8	5	3	16
Shkreli	Reçi	1	Catholic		Riola	10	5	1	16
Shkreli	Reçi	1	Catholic		Reçi	4	8	1	13
Shkreli	Reçi	1	Moslem		Loya	13	1	0	14
Shkreli	Kastrati	3	Catholic		Postripa		1	10	11
Shkreli	Klementi	3	Catholic		Triepsh	0	6	0	6
Riola	Riola	1	Moslem		Kraja (Yugo)	0	1	0	1
Riola	Loya	1	Moslem						
Riola	Greisha	3	Moslem						
Riola	Koplik	2	Moslem						
Riola	Reçi	3	Moslem						
Riola	Shkreli	1	Moslem						

FATHER	MOTHER	No.	RELIGION	NOTES	FATHER	MOTHER	No.	RELIGION	NOTES
<i>Dukagin</i>					<i>Has</i>				
Shoshi	Shoshi	4	Catholic		Has	Has (Vlana)	101	Moslem	No <i>bairak</i> data recorded. Probably no Ershan, all Vlana.
Shoshi	Shala	16	Catholic		Has	Has (Vlana)	13	Catholic	
Shoshi	Kiri	3	Catholic				114	13 Catholics,	
Shoshi	Dushman	1	Catholic					101 Moslems	
Shoshi	Pulati								
	(Kiri or Plani)	1	Catholic						
Shala	Shala	48	Catholic		<i>Luma</i>				
Shala	Shoshi	30	Catholic		Biçani	Biçani	50	Moslem	
Shala	Kiri	1	Catholic		Biçani	Kalishi	6	Moslem	
Shala	Dushman	1	Catholic		Biçani	Ujmisht	4	Moslem	
Shala	Toplana	1	Catholic		Biçani	Dolovisht	3	Moslem	
Total		106	All Catholics		Kalishi	Kalishi	5	Moslem	
<i>Malsia e Jakovës</i>					Ujmisht	Ujmisht	23	Moslem	
Krasniqi	Krasniqi	3	Moslem		Ujmisht	Biçani	2	Moslem	
Krasniqi	Gashi	16	Moslem		Dolovisht	Dolovisht	6	Moslem	
Krasniqi	Bituç	2	Moslem		Dolovisht	Biçani	1	Moslem	
Krasniqi	Vunshaj	4	Moslem	M. Yugoslavia	Çaja	Çaja	1	Moslem	
Krasniqi	Grasia	1	Moslem	M. Yugoslavia	Topojan	Topojan	2	Moslem	I do not know whether these places are <i>fis</i> or <i>bairaks</i> , nor where they are, except that they are all part of Luma.
Gashi	Gashi	20	Moslem	2 of Shala <i>fis</i>	Borfa	Borfa	1	Moslem	
Gashi	Krasniqi	16	Moslem		Dom	Dom	1	Moslem	
Gashi	Bituç	7	Moslem		Pakç	Pakç	1	Moslem	
Gashi	Kastrati	2	Moslem	Kastrati a <i>fis</i>	Lofme	Lofme	1	Moslem	
Gashi	Hoti	2	Moslem	Hoti <i>fis</i> in Yugo.	Bele	Bele	1	Moslem	
Gashi	Marina	1	Moslem	Marina <i>fis</i> in Yugo.	Probres	Probres	1	Moslem	
Gashi	Junik (sp. ?)	1	Moslem	Junik <i>fis</i> in Yugo.	Total		109	109 Moslems	
Bituç	Krasniqi	1	Moslem		<i>Puka</i>				
Bituç	Gashi	3	Moslem		Kabash	Puka	6	Moslem	
Kastrati	Gashi	1	Moslem		Kabash	Çeret	7	Moslem	
Marina	Krasniqi	1	Moslem		Kabash	Mal i Zi	6	Moslem	
Marina	Gashi	1	Moslem		Kabash	Buxhon	1	Moslem	
Marina	Bituç	1	Moslem		Kabash	Buxhon	1	Catholic	
Vunshaj	Krasniqi	1	Moslem		Kabash	Iballja	1	Catholic	
Vunshaj	Gashi	3	Moslem		Puka	Puka	5	Moslem	
Merturi	Nikaj	16	Catholic		Kabash	Kabash	5	Moslem	
Nikaj	Merturi	1	Catholic		Kabash	Kabash	1	Catholic	
Total		104	17 Catholics,		Çeret	Çeret	1	Moslem	
					Mal i Zi	Mal i Zi	1	Moslem	

FATHER	MOTHER	No.	RELIGION	NOTES	FATHER	MOTHER	No.	RELIGION	NOTES
<i>Puka</i>					<i>Mirdita</i>				
Çeret	Puka	11	Moslem		Spaç	Fan	15	Catholic	
Çeret	Kabash	5	Moslem		Spaç	Dibri	5	Catholic	
Çeret	Mal i Zi	1	Moslem		Kushnen	Dibri	15	Catholic	
Mal i Zi	Mal i Zi	6	Moslem		Total		101	101 Catholics	
Mal i Zi	Kabash	3	Moslem		<i>Zadrina</i>				
Berisha	Berisha (Thach)	2	Catholic	1 parent Thach.	Zadrina	Zadrina	92	Catholic	
Berisha	Çeret	2	Catholic		Zadrina	Zadrina	13	Moslem	
Berisha	Mal i Zi	1	Catholic		Total		105	92 Catholics 13 Moslems	
Berisha	Buxhon	6	Catholic		<i>Mati</i>				
Buxhon	Buxhon	2	Catholic		Mat	Mat	77	Moslem	
Buxhon	Berisha	1	Catholic		Mat	Lura	1	Moslem	
Buxhon	Iballja	1	Catholic		Lura	Lura	12	Moslem	
Iballja	Iballja	6	Catholic		Lura	Lura	1	Catholic	
Iballja	Kabash	4	Moslem		Lura	Selita	1	Catholic	
Iballja	Puka	1	Moslem		Lura	Kthella	1	Catholic	
Iballja	Puka	1	Catholic		Selita	Selita	3	Moslem	
Iballja	Mal i Zi	2	Moslem		Selita	Selita	3	Catholic	
Iballja	Berisha	5	Catholic		Selita	Lura	1	Moslem	
Iballja	Buxhon	3	Catholic		Selita	Kthella	2	Catholic	
Total		102	65 Moslems 37 Catholics		Kthella	Kthella	2	Catholic	
<i>Mirdita</i>					Total		104	10 Catholics 94 Moslems	
Dibri	Dibri	28	Catholic		<i>Dibra</i>				
Dibri	Orosh	3	Catholic		Stashani	Stashani	38	Moslem	
Dibri	Spaç	6	Catholic		Sheheri	Sheheri	23	Moslem	
Dibri	Kushnen	6	Catholic		Poshtar	Poshtar	1	Orthodox	
Fan	Fan	3	Catholic		Sheheri	Sheheri	5	Moslem	
Fan	Orosh	4	Catholic		Epert	Epert	1	Moslem	
Fan	Kushnen	3	Catholic		Sheheri	Poshtar	40	Moslem	
Fan	Spaç	1	Catholic		Epert	Reçi	108	107 Moslems 1 Orthodox	
Orosh	Orosh	2	Catholic	Mother's village formerly with Kthella.	Sheheri	Sheheri	1	Moslem	
Orosh	Fan	8	Catholic		Epert	Poshtar	1	Moslem	
Orosh	Kushnen	1	Catholic		Reçi	Reçi	40	Moslem	
Orosh	Dibri	1	Catholic		Total		108	107 Moslems 1 Orthodox	

TABLE 3: MEASUREMENTS AND INDICES

TABLE 4: OBSERVATIONS

TABLE 3: MEASUREMENTS AND INDICES

A. NUMBER/RANGE

MEAN $\pm$ P.E.

Measurements

Total Series

MEM

DUK

MEJ

HAS

LUM

PUK

MIR

ZAD

MAT

DIB

Stature	1065/143-193	105/155-190	106/155-190	104/158-187	113/143-193	109/155-190	102/152-184	101/146-184	104/149-181	104/152-184	108/152-187
	169.71 $\pm$.14	172.77 $\pm$.41	173.52 $\pm$.41	172.47 $\pm$.36	170.82 $\pm$.46	169.47 $\pm$.38	169.17 $\pm$.43	166.68 $\pm$.39	166.98 $\pm$.42	166.86 $\pm$.41	168.42 $\pm$.44
Span	1062/152-205	105/161-199	106/164-205	102/161-196	113/155-202	109/158-193	102/152-193	101/158-190	105/158-199	104/155-190	106/155-196
	176.37 $\pm$.17	180.03 $\pm$.51	182.25 $\pm$.45	178.74 $\pm$.43	178.47 $\pm$.51	173.97 $\pm$.47	176.16 $\pm$.47	173.64 $\pm$.42	174.87 $\pm$.47	171.87 $\pm$.52	173.70 $\pm$.54
Sitting height	1065/69-101	105/81-101	106/81-98	103/84-101	114/78-98	109/89-101	102/78-101	100/78-95	105/78-98	104/78-98	108/78-98
	89.44 $\pm$.08	90.82 $\pm$.23	90.73 $\pm$.21	91.00 $\pm$.19	89.77 $\pm$.24	89.29 $\pm$.26	89.56 $\pm$.26	87.43 $\pm$.22	88.36 $\pm$.23	88.81 $\pm$.23	88.57 $\pm$.22
Biacromial diameter	1067/31-48	105/34-48	106/31-48	104/34-45	114/31-45	109/34-42	102/34-42	101/31-42	105/31-45	104/31-45	108/31-45
	38.59 $\pm$.05	39.71 $\pm$.14	40.37 $\pm$.14	39.29 $\pm$.13	38.30 $\pm$.13	38.45 $\pm$.10	37.91 $\pm$.12	37.46 $\pm$.13	37.94 $\pm$.12	38.30 $\pm$.14	37.94 $\pm$.15
Bi-iliac	1067/22-39	105/28-36	106/28-36	104/25-36	114/25-39	109/25-36	102/25-39	101/22-36	105/22-36	104/25-36	108/25-36
	30.44 $\pm$.04	30.71 $\pm$.11	31.19 $\pm$.10	30.56 $\pm$.12	31.13 $\pm$.12	30.14 $\pm$.11	30.38 $\pm$.13	30.11 $\pm$.12	29.78 $\pm$.14	29.96 $\pm$.12	30.68 $\pm$.13
Chest breadth	1067/23-40	105/23-34	106/23-37	104/23-34	114/23-37	109/23-34	102/23-34	101/23-34	105/23-34	104/23-34	108/23-40
	28.56 $\pm$.04	29.40 $\pm$.12	28.53 $\pm$.12	28.71 $\pm$.12	29.16 $\pm$.12	28.56 $\pm$.12	28.35 $\pm$.12	28.05 $\pm$.12	28.68 $\pm$.13	28.20 $\pm$.11	28.23 $\pm$.13
Chest depth	1066/18-35	105/20-29	106/20-35	104/20-31	114/18-29	109/20-29	102/20-33	101/20-31	104/20-31	104/20-29	108/20-29
	24.26 $\pm$.04	23.92 $\pm$.11	25.24 $\pm$.12	24.54 $\pm$.11	24.42 $\pm$.12	24.16 $\pm$.09	23.98 $\pm$.11	24.02 $\pm$.12	24.52 $\pm$.07	23.92 $\pm$.12	23.82 $\pm$.10
Head length	1067/154-211	105/170-208	106/176-205	104/167-208	114/167-211	109/170-208	102/167-208	101/173-202	105/170-199	104/167-202	108/154-202
	186.18 $\pm$.15	186.42 $\pm$.46	189.60 $\pm$.39	189.09 $\pm$.48	184.56 $\pm$.42	188.28 $\pm$.42	186.42 $\pm$.48	186.57 $\pm$.45	183.15 $\pm$.39	182.91 $\pm$.45	184.56 $\pm$.45
Head breadth	1067/138-179	105/147-179	106/147-176	104/138-173	114/138-176	109/141-173	102/141-170	101/144-173	105/144-173	104/144-176	108/138-176
	157.78 $\pm$.12	161.59 $\pm$.37	160.06 $\pm$.33	156.70 $\pm$.39	157.87 $\pm$.45	155.38 $\pm$.36	156.19 $\pm$.37	157.09 $\pm$.39	158.74 $\pm$.37	157.81 $\pm$.38	156.43 $\pm$.33
Head height	1067/110-145	105/113-142	106/113-145	104/110-145	114/110-145	109/110-142	102/113-145	101/116-142	105/113-145	104/113-142	108/113-145
	128.34 $\pm$.12	129.30 $\pm$.37	127.56 $\pm$.40	129.39 $\pm$.38	128.46 $\pm$.43	128.34 $\pm$.36	128.49 $\pm$.38	128.25 $\pm$.36	130.47 $\pm$.42	126.36 $\pm$.39	126.51 $\pm$.35
Min. frontal diameter	1067/89-128	105/97-124	106/97-120	104/97-128	114/89-124	109/89-120	102/97-124	101/97-120	105/93-128	104/93-124	108/97-124
	108.86 $\pm$.10	112.42 $\pm$.31	109.98 $\pm$.28	109.98 $\pm$.30	107.26 $\pm$.32	108.90 $\pm$.31	108.78 $\pm$.32	107.98 $\pm$.30	107.70 $\pm$.33	108.30 $\pm$.36	108.82 $\pm$.30
Bizygomatic diameter	1067/115-164	105/120-164	106/120-159	104/125-159	114/125-159	109/130-154	102/115-154	101/130-159	105/120-159	104/122-153	108/125-154
	142.35 $\pm$.12	144.30 $\pm$.41	144.25 $\pm$.38	142.80 $\pm$.49	142.15 $\pm$.35	142.15 $\pm$.32	141.60 $\pm$.38	142.85 $\pm$.33	141.10 $\pm$.40	141.40 $\pm$.38	140.55 $\pm$.35
Bigonial diameter	1067/86-133	105/86-121	106/90-125	104/94-133	114/90-125	109/94-125	102/90-125	101/90-125	105/90-125	104/94-125	108/86-121
	107.70 $\pm$.13	108.62 $\pm$.41	109.10 $\pm$.37	108.82 $\pm$.40	108.14 $\pm$.41	107.10 $\pm$.35	107.30 $\pm$.43	106.62 $\pm$.39	107.22 $\pm$.41	107.46 $\pm$.40	106.78 $\pm$.38
Total face height*	921/95-144	82/105-139	101/110-144	95/105-144	93/110-144	99/110-139	92/95-134	80/105-134	96/105-139	93/105-144	85/105-139
	123.90 $\pm$.14	124.15 $\pm$.52	123.85 $\pm$.43	124.45 $\pm$.48	126.30 $\pm$.43	124.55 $\pm$.37	121.15 $\pm$.45	120.60 $\pm$.43	122.90 $\pm$.46	123.60 $\pm$.46	124.05 $\pm$.43
Upper face height*	921/55-89	82/60-84	101/60-84	95/55-89	93/65-89	99/60-89	92/60-84	80/60-84	96/55-84	93/60-84	85/60-89
	73.55 $\pm$.11	73.40 $\pm$.37	73.40 $\pm$.32	73.55 $\pm$.35	76.70 $\pm$.34	74.05 $\pm$.32	72.50 $\pm$.31	72.90 $\pm$.35	72.65 $\pm$.34	72.55 $\pm$.37	73.55 $\pm$.38
Nose height	1066/44-71	105/48-71	106/48-67	104/44-71	113/48-71	109/48-71	102/48-67	101/44-67	105/44-67	104/48-71	108/48-67
	58.10 $\pm$.09	58.58 $\pm$.27	56.78 $\pm$.25	57.86 $\pm$.27	59.98 $\pm$.28	58.46 $\pm$.28	56.50 $\pm$.25	58.26 $\pm$.27	57.86 $\pm$.27	58.14 $\pm$.28	58.62 $\pm$.25
Nose breadth	1066/22-48	105/22-42	106/28-42	104/28-42	113/28-48	109/28-42	102/25-42	101/25-42	105/25-42	104/25-42	108/28-42
	33.77 $\pm$.06	34.19 $\pm$.20	34.07 $\pm$.19	34.10 $\pm$.16	34.79 $\pm$.21	33.20 $\pm$.18	33.29 $\pm$.19	33.71 $\pm$.20	33.26 $\pm$.20	33.23 $\pm$.19	33.83 $\pm$.18
Indices											
Relative span	1060/96-115	105/100-109	106/98-111	102/96-111	112/98-111	109/98-109	102/98-111	101/98-115	104/96-113	104/98-109	106/96-109
	103.94 $\pm$.05	104.18 $\pm$.14	105.02 $\pm$.16	103.74 $\pm$.17	104.40 $\pm$.15	102.84 $\pm$.16	104.12 $\pm$.15	104.34 $\pm$.18	104.74 $\pm$.17	103.12 $\pm$.16	103.06 $\pm$.17
Relative sitting height	1063/42-59	105/48-55	106/48-55	103/50-55	113/48-55	109/42-57	102/48-57	100/48-59	104/48-59	104/50-57	108/48-57
	52.76 $\pm$.03	52.48 $\pm$.09	52.38 $\pm$.09	52.76 $\pm$.08	52.58 $\pm$.08	52.84 $\pm$.11	52.90 $\pm$.10	52.48 $\pm$.10	53.20 $\pm$.11	53.28 $\pm$.10	52.80 $\pm$.09
Relative shoulder height	1064/74-89	105/80-85	106/80-85	104/80-87	113/80-87	109/80-85	102/80-85	101/74-89	103/78-87	104/80-87	108/78-87
	82.04 $\pm$.03	82.12 $\pm$.08	82.00 $\pm$.06	82.28 $\pm$.07	82.22 $\pm$.07	81.86 $\pm$.07	81.90 $\pm$.08	81.82 $\pm$.10	81.94 $\pm$.09	81.96 $\pm$.08	82.34 $\pm$.09
Rel. shoulder breadth	1065/18-27	105/20-27	106/20-27	104/20-27	113/20-25	109/20-25	102/20-25	101/18-25	104/20-27	104/20-27	108/18-25
	22.76 $\pm$.02	22.94 $\pm$.07	23.38 $\pm$.07	22.84 $\pm$.07	22.44 $\pm$.07	22.82 $\pm$.06	22.48 $\pm$.08	22.40 $\pm$.08	22.74 $\pm$.08	22.90 $\pm$.09	22.62 $\pm$.09
Thoracic index	1066	105	106	104	114	109	102	101	104	104	108
	84.94	81.39	88.47	85.33	83.71	84.59	84.59	85.63	85.50	84.82	84.38

*Corrected for face shortening.

Indices (Continued)		Total Series	MEM	DUK	MEJ	HAS	LUM	PUK	MIR	ZAD	MAT	DIB
Cephalic Index		1067/70-99	105/77-97	106/74-97	104/71-94	114/71-97	109/74-99	102/74-97	101/74-97	105/77-97	104/74-97	108/74-97
		84.84 ± .09	86.79 ± .25	84.54 ± .24	83.04 ± .28	85.59 ± .28	82.62 ± .27	83.76 ± .26	84.39 ± .27	86.67 ± .24	86.49 ± .27	84.96 ± .26
Length-height Index . .		1067/58-81	105/58-81	106/61-78	104/58-78	114/58-78	109/61-78	102/64-81	101/61-78	105/64-81	104/58-78	108/61-78
		69.02 ± .07	69.50 ± .22	67.28 ± .23	68.63 ± .22	69.77 ± .24	68.18 ± .21	69.08 ± .21	68.84 ± .22	71.45 ± .22	69.05 ± .25	68.66 ± .24
Breadth-height index. .		1067/57-99	105/70-90	106/70-93	104/73-99	114/67-93	109/70-93	102/73-93	101/73-93	105/73-93	104/70-93	108/70-93
		81.47 ± .09	80.03 ± .24	79.73 ± .27	82.49 ± .26	81.50 ± .31	82.85 ± .26	82.43 ± .27	81.80 ± .24	82.31 ± .25	80.18 ± .26	81.08 ± .23
Fronto-parietal index .		1067/57-86	105/60-77	106/60-86	104/63-80	114/60-80	109/60-80	102/60-77	101/60-80	105/60-77	104/57-77	108/60-77
		69.07 ± .07	68.56 ± .18	69.19 ± .21	70.24 ± .21	68.08 ± .23	69.94 ± .22	69.58 ± .24	68.86 ± .23	68.08 ± .22	68.53 ± .22	69.70 ± .20
Cephalo-facial index . .		1067/73-105	105/76-96	106/73-99	104/82-102	114/79-99	109/82-102	102/76-99	101/82-99	105/76-96	104/76-99	108/76-105
		90.26 ± .07	89.48 ± .21	90.11 ± .22	90.89 ± .22	90.26 ± .21	91.61 ± .22	90.53 ± .24	90.83 ± .20	88.88 ± .21	89.60 ± .23	90.02 ± .25
Zygo-frontal index . . .		1067/64-95	105/68-87	106/68-95	104/68-87	114/64-83	109/68-87	102/68-91	101/68-83	105/64-91	104/64-87	108/68-91
		76.74 ± .08	76.86 ± .23	76.98 ± .23	77.30 ± .23	76.54 ± .20	76.74 ± .23	76.94 ± .26	75.74 ± .22	76.90 ± .27	76.46 ± .25	77.46 ± .25
Fronto-gonial index . .		1067/70-124	105/75-114	106/80-114	104/85-119	114/70-124	109/85-119	102/80-199	101/80-114	105/85-119	104/80-119	108/80-119
		98.90 ± .13	97.40 ± .42	98.90 ± .37	98.90 ± .37	100.55 ± .46	99.30 ± .37	99.00 ± .42	98.30 ± .46	99.35 ± .44	99.45 ± .46	98.00 ± .42
Zygo-gonial Index		1067/57-95	105/57-86	106/63-86	104/66-86	114/66-86	109/66-83	102/60-95	101/66-89	105/66-89	104/66-89	108/66-86
		75.73 ± .08	75.10 ± .29	75.85 ± .27	76.21 ± .23	76.12 ± .25	75.37 ± .24	75.94 ± .28	74.86 ± .26	76.12 ± .28	76.00 ± .25	75.88 ± .24
Facial index		921/74-109	82/74-105	101/74-101	95/74-109	93/78-105	99/78-101	92/74-101	80/74-97	96/78-101	93/74-105	85/78-97
		87.06 ± .11	86.10 ± .42	85.72 ± .32	87.79 ± .37	89.35 ± .35	87.90 ± .28	85.93 ± .35	85.90 ± .30	87.33 ± .35	87.37 ± .36	87.78 ± .27
Upper facial index . . .		921/37-69	82/43-60	101/43-69	95/37-66	93/46-66	99/46-60	92/43-63	80/43-60	96/43-60	93/43-60	85/43-63
		51.41 ± .08	50.73 ± .27	50.86 ± .24	51.80 ± .26	54.35 ± .28	51.97 ± .22	51.21 ± .23	48.61 ± .22	51.75 ± .23	51.58 ± .27	53.25 ± .28
Nasal Index		1066/40-83	105/40-71	106/44-79	104/48-79	113/44-75	109/44-71	102/44-79	101/44-75	105/40-75	104/40-75	108/44-83
		58.38 ± .12	58.82 ± .41	60.06 ± .40	59.50 ± .36	57.90 ± .38	56.18 ± .33	59.22 ± .42	58.22 ± .37	57.62 ± .41	57.58 ± .45	57.62 ± .37

B. STANDARD DEVIATION ± P.E.

Measurements

Stature	6.72 ± .10	6.24 ± .29	6.21 ± .29	5.52 ± .26	7.26 ± .33	5.91 ± .27	6.42 ± .30	5.82 ± .28	6.33 ± .30	6.21 ± .29	6.78 ± .31
Span	8.01 ± .12	7.68 ± .36	6.90 ± .32	6.51 ± .31	8.10 ± .36	7.29 ± .33	7.11 ± .34	6.27 ± .30	7.17 ± .33	7.92 ± .37	8.28 ± .38
Sitting height	3.69 ± .05	3.45 ± .16	3.24 ± .15	2.88 ± .14	3.84 ± .17	3.96 ± .18	3.93 ± .19	3.27 ± .16	3.48 ± .16	3.54 ± .17	3.42 ± .16
Biacromial diameter . .	2.19 ± .03	2.13 ± .10	2.07 ± .10	2.01 ± .09	2.13 ± .10	1.62 ± .07	1.86 ± .09	1.98 ± .09	1.89 ± .09	2.16 ± .10	2.31 ± .11
Bi-iliac	1.89 ± .03	1.71 ± .08	1.47 ± .07	1.77 ± .08	1.86 ± .08	1.71 ± .08	2.01 ± .09	1.83 ± .08	2.07 ± .10	1.86 ± .09	2.04 ± .09
Chest breadth	1.89 ± .03	1.86 ± .09	1.89 ± .09	1.77 ± .08	1.83 ± .08	1.86 ± .08	1.77 ± .08	1.77 ± .08	2.04 ± .09	1.72 ± .08	2.04 ± .09
Chest depth	1.78 ± .03	1.72 ± .08	1.88 ± .08	1.70 ± .08	1.92 ± .08	1.42 ± .06	1.70 ± .08	1.84 ± .09	1.04 ± .05	1.78 ± .08	1.50 ± .07
Head length	7.08 ± .10	6.99 ± .33	6.00 ± .28	7.32 ± .34	6.60 ± .29	6.51 ± .30	7.26 ± .34	6.69 ± .32	6.00 ± .28	6.84 ± .32	6.90 ± .32
Head breadth	6.00 ± .09	5.64 ± .26	5.17 ± .23	5.88 ± .28	7.05 ± .31	5.52 ± .25	5.52 ± .26	5.88 ± .28	5.55 ± .26	5.82 ± .27	5.13 ± .24
Head height	6.03 ± .09	5.61 ± .26	6.08 ± .29	5.73 ± .27	6.81 ± .30	5.55 ± .25	5.73 ± .27	5.34 ± .25	5.43 ± .25	5.88 ± .28	5.43 ± .25
Min. frontal diameter .	4.92 ± .07	4.68 ± .22	4.20 ± .19	4.60 ± .22	5.08 ± .23	4.76 ± .22	4.80 ± .23	4.52 ± .21	4.96 ± .23	5.40 ± .25	4.56 ± .21
Bi-zygomatic diameter .	5.65 ± .08	6.30 ± .29	5.85 ± .27	7.40 ± .35	5.50 ± .25	4.95 ± .23	5.70 ± .27	4.85 ± .23	6.15 ± .29	5.81 ± .27	5.40 ± .25
Biogonial diameter . .	6.12 ± .09	6.20 ± .29	5.60 ± .26	6.00 ± .28	6.48 ± .29	5.48 ± .25	6.44 ± .32	5.88 ± .28	6.04 ± .28	5.92 ± .27	5.92 ± .27
Total face height* . . .	6.50 ± .10	6.95 ± .37	6.35 ± .30	7.00 ± .34	6.15 ± .30	5.50 ± .26	6.40 ± .32	5.70 ± .30	6.75 ± .33	6.60 ± .33	5.85 ± .30
Upper face height* . . .	5.00 ± .08	5.00 ± .26	4.70 ± .22	5.10 ± .25	4.85 ± .24	4.72 ± .23	4.40 ± .22	4.60 ± .25	5.00 ± .24	5.35 ± .26	5.25 ± .27
Nose height	4.20 ± .06	4.16 ± .10	3.84 ± .18	4.04 ± .19	4.40 ± .20	4.28 ± .20	3.72 ± .18	4.08 ± .19	4.12 ± .19	4.28 ± .20	3.88 ± .18
Nose breadth	2.76 ± .04	3.06 ± .14	2.97 ± .14	2.37 ± .11	3.27 ± .15	2.76 ± .13	2.88 ± .14	2.94 ± .14	3.03 ± .14	2.94 ± .14	2.73 ± .13

Indices

Relative span	2.56 ± .04	2.20 ± .10	2.48 ± .11	2.60 ± .12	2.34 ± .11	2.42 ± .11	2.26 ± .11	2.68 ± .13	2.60 ± .12	2.46 ± .12	2.64 ± .12
Relative sitting height .	1.50 ± .02	1.44 ± .07	1.38 ± .06	1.24 ± .06	1.32 ± .06	1.76 ± .08	1.50 ± .07	1.48 ± .07	1.62 ± .08	1.46 ± .07	1.46 ± .07
Rel. shoulder height . .	1.24 ± .02	1.14 ± .05	.98 ± .05	1.12 ± .05	1.14 ± .05	1.08 ± .05	1.18 ± .06	1.54 ± .07	1.30 ± .06	1.24 ± .06	1.36 ± .06
Rel. shoulder breadth .	1.20 ± .02	1.16 ± .05	1.12 ± .05	1.06 ± .05	1.12 ± .05	1.00 ± .05	1.14 ± .05	1.18 ± .06	1.20 ± .06	1.34 ± .06	1.32 ± .06
Thoracic index											
Cephalic index	4.29 ± .06	3.81 ± .18	3.60 ± .17	4.23 ± .20	4.50 ± .20	4.14 ± .19	3.93 ± .19	3.96 ± .19	3.63 ± .17	4.11 ± .19	3.96 ± .18
Length-height Index . .	3.63 ± .05	3.33 ± .15	3.48 ± .16	3.36 ± .16	3.81 ± .17	3.30 ± .15	3.12 ± .15	3.27 ± .16	3.39 ± .16	3.84 ± .18	3.69 ± .17

*Corrected for face shortening.

Indices (Continued)	Total Series	MEM	DUK	MEJ	HAS	LUM	PUK	MIR	ZAD	MAT	DIB
Breadth-height index	4.17 + .06	3.72 + .17	4.11 + .19	3.90 + .18	4.95 + .19	4.05 + .19	4.08 + .19	3.57 + .17	3.81 + .18	3.93 + .18	3.60 + .17
Fronto-parietal index	3.39 + .05	2.79 + .13	3.27 + .15	3.18 + .15	3.72 + .17	3.39 + .15	3.57 + .17	3.40 + .17	3.30 + .15	3.33 + .16	3.03 + .14
Cephalo-facial index	3.48 + .05	3.12 + .15	3.39 + .16	3.42 + .16	3.27 + .15	3.33 + .15	3.57 + .17	2.97 + .14	3.18 + .15	3.48 + .16	3.78 + .17
Zygo-frontal index	3.72 + .05	3.56 + .17	3.52 + .16	3.52 + .16	3.16 + .14	3.52 + .16	3.88 + .18	3.28 + .16	4.12 + .19	3.72 + .17	3.84 + .18
Fronto-gonial index	6.45 + .09	6.40 + .30	5.60 + .26	5.60 + .26	7.30 + .33	5.70 + .26	6.30 + .30	6.90 + .32	6.65 + .31	6.90 + .32	6.40 + .29
Zygo-gonial index	3.99 + .06	4.41 + .21	4.11 + .19	3.51 + .16	4.02 + .18	3.66 + .17	4.20 + .20	3.93 + .19	4.32 + .20	3.84 + .18	3.72 + .17
Facial index	5.04 + .08	5.64 + .30	4.80 + .23	5.28 + .26	5.00 + .25	4.20 + .20	5.04 + .25	3.96 + .21	5.10 + .25	5.26 + .26	4.16 + .19
Upper facial index	3.63 + .06	3.66 + .27	3.54 + .17	3.69 + .18	3.99 + .20	3.24 + .16	3.24 + .16	2.97 + .16	3.33 + .16	3.80 + .19	3.86 + .20
Nasal index	6.04 + .09	6.28 + .29	6.12 + .28	5.40 + .25	6.00 + .27	5.08 + .23	6.32 + .30	5.56 + .26	6.24 + .29	6.76 + .32	5.64 + .21

C: COEFFICIENT OF VARIATION + P.E.

Measurements

Stature	3.96 + .08	3.61 + .17	3.58 + .17	3.20 + .15	4.25 + .19	3.49 + .16	3.79 + .18	3.49 + .17	3.79 + .18	3.72 + .17	4.03 + .1
Span	4.54 + .09	4.27 + .20	3.79 + .18	3.64 + .17	4.54 + .20	4.19 + .19	4.04 + .19	3.61 + .17	4.10 + .19	4.61 + .22	4.77 + .2
Sitting height	4.13 + .09	3.80 + .18	3.57 + .17	3.16 + .15	4.28 + .19	4.43 + .20	4.39 + .21	3.74 + .18	3.94 + .18	3.99 + .19	3.86 + .1
Biacromial diameter	5.68 + .08	5.36 + .25	5.13 + .24	5.12 + .24	5.56 + .25	4.21 + .19	4.91 + .23	5.29 + .25	4.98 + .23	5.64 + .26	6.09 + .2
Bi-iliac	6.21 + .13	5.57 + .26	4.71 + .22	5.79 + .27	5.97 + .27	5.67 + .26	6.62 + .31	6.08 + .29	6.95 + .32	6.21 + .29	6.65 + .3
Chest breadth	6.62 + .14	6.32 + .29	6.62 + .31	6.17 + .29	6.28 + .28	6.51 + .30	6.24 + .29	6.31 + .30	7.11 + .33	5.74 + .27	7.23 + .3
Chest depth	7.34 + .15	7.19 + .33	7.45 + .35	6.93 + .32	7.86 + .35	5.88 + .27	7.09 + .33	7.66 + .36	4.24 + .20	7.44 + .35	6.30 + .2
Head length	3.80 + .08	3.21 + .15	3.16 + .15	3.87 + .18	3.58 + .16	3.46 + .16	3.89 + .18	3.59 + .17	3.28 + .15	3.74 + .17	3.74 + .1
Head breadth	3.80 + .08	3.49 + .16	3.17 + .15	3.75 + .18	4.47 + .20	3.55 + .16	3.53 + .17	3.74 + .18	3.50 + .16	3.69 + .17	3.28 + .1
Head height	4.70 + .10	4.42 + .21	4.84 + .22	4.43 + .21	5.30 + .24	4.32 + .20	4.46 + .21	4.16 + .20	4.94 + .23	4.65 + .22	4.29 + .2
Min. frontal diameter	4.52 + .09	4.16 + .19	3.82 + .18	4.18 + .20	4.74 + .21	4.37 + .20	4.41 + .21	4.19 + .20	4.61 + .21	4.99 + .23	4.19 + .1
Bizygomatic diameter	3.97 + .08	4.37 + .20	4.04 + .19	5.18 + .24	3.87 + .17	3.48 + .16	4.02 + .19	5.51 + .26	4.36 + .20	4.11 + .19	3.84 + .1
Bigonial diameter	5.68 + .11	5.71 + .27	5.13 + .24	5.51 + .26	5.99 + .27	5.12 + .23	6.00 + .28	5.51 + .26	5.78 + .27	5.62 + .26	5.54 + .2
Total face height*	5.25 + .08	5.60 + .29	5.13 + .24	5.62 + .27	4.87 + .24	4.42 + .21	5.28 + .26	4.73 + .25	5.49 + .27	5.34 + .26	4.72 + .2
Upper face height*	6.80 + .11	6.81 + .36	6.40 + .30	6.93 + .34	6.32 + .31	6.37 + .31	6.07 + .30	6.31 + .34	6.88 + .33	7.37 + .36	7.14 + .2
Nose height	7.23 + .15	7.10 + .33	6.76 + .31	6.98 + .33	7.34 + .33	7.32 + .33	6.58 + .31	7.00 + .33	7.12 + .33	7.36 + .34	6.62 + .2
Nose breadth	8.17 + .17	8.95 + .42	8.72 + .40	6.95 + .33	9.40 + .42	8.31 + .38	8.65 + .41	8.72 + .41	9.11 + .42	8.85 + .41	8.07 + .2

Indices

Relative span	2.46 + .05	2.11 + .10	2.36 + .11	2.51 + .12	2.24 + .10	2.35 + .11	2.17 + .10	2.57 + .12	2.48 + .12	2.39 + .11	2.56 + .1
Relative sitting height	2.84 + .06	2.74 + .13	2.63 + .12	2.35 + .11	2.51 + .11	3.33 + .15	2.84 + .13	2.82 + .13	3.05 + .14	2.74 + .13	2.77 + .1
Relative shoulder height	1.51 + .03	1.39 + .06	1.20 + .06	1.36 + .06	1.39 + .06	1.32 + .06	1.44 + .07	1.88 + .09	1.59 + .07	1.51 + .07	1.65 + .0
Rel. shoulder breadth	5.27 + .11	5.06 + .24	4.79 + .22	4.64 + .22	4.99 + .22	4.38 + .20	5.07 + .24	5.27 + .25	5.28 + .25	5.85 + .27	5.84 + .2
Thoracic index											
Cephalic index	5.06 + .10	4.39 + .20	4.26 + .19	5.09 + .24	5.26 + .23	5.01 + .23	4.69 + .22	4.69 + .22	4.19 + .20	4.75 + .22	4.66 + .2
Length-height index	5.26 + .11	4.79 + .22	5.17 + .24	4.90 + .23	5.46 + .24	4.84 + .22	4.52 + .21	4.75 + .23	4.74 + .22	5.56 + .26	5.37 + .2
Breadth-height index	5.12 + .11	4.65 + .22	5.15 + .24	4.73 + .22	6.08 + .24	4.89 + .22	4.95 + .23	4.36 + .21	4.63 + .22	4.90 + .23	4.44 + .2
Fronto-parietal index	4.91 + .10	4.07 + .19	4.73 + .22	4.53 + .21	5.46 + .24	4.85 + .22	5.13 + .24	5.05 + .24	4.85 + .23	4.86 + .23	4.35 + .2
Cephalo-facial index	3.86 + .08	3.49 + .16	3.76 + .17	3.76 + .18	3.62 + .16	3.63 + .17	3.94 + .19	4.33 + .21	3.58 + .17	3.88 + .18	4.20 + .1
Zygo-frontal index	4.85 + .10	4.63 + .22	4.57 + .21	4.55 + .21	4.13 + .18	4.59 + .21	5.04 + .24	4.37 + .25	5.36 + .25	4.87 + .23	4.96 + .2
Fronto-gonial index	6.52 + .13	6.57 + .31	5.66 + .27	5.66 + .26	7.26 + .32	5.74 + .26	6.36 + .30	7.02 + .33	6.69 + .31	6.94 + .32	6.53 + .3
Zygo-gonial index	5.27 + .11	5.87 + .27	5.42 + .25	4.61 + .22	5.28 + .24	4.86 + .22	5.53 + .26	5.25 + .25	5.68 + .26	5.05 + .24	4.90 + .2
Facial index	5.73 + .09	6.55 + .34	5.60 + .27	6.01 + .29	5.60 + .28	4.78 + .23	5.86 + .29	4.61 + .25	5.84 + .28	6.02 + .30	4.77 + .2
Upper facial index	7.06 + .11	7.21 + .38	6.96 + .33	7.12 + .35	7.34 + .36	6.23 + .30	6.33 + .31	6.11 + .33	6.43 + .31	7.37 + .36	7.25 + .3
Nasal index	10.35 + .21	10.68 + .50	10.19 + .47	9.08 + .42	10.36 + .46	8.86 + .41	10.67 + .50	9.55 + .45	9.83 + .46	8.74 + .41	9.79 + .4

*Corrected for face shortening.

TABLE 4: OBSERVATIONS

Total Series		MEM		DUK		MEJ		HAS		LUM		PUK		MIR		ZAD		MAT		DIB	
#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
I. BODY																					
Total	1066	105	106	104	114	109	102	101	104	104	108	104	108	108	108	104	104	104	108	108	108
General musculature																					
ssm	2	19	5	12	11.54	14	1	.98	1	12.84	19	18.63	27	26.73	30	28.85	27	25.96	28	25.93	28
sm	200	18.76	62	58.49	81	77.88	76	66.67	76	69.72	57	55.88	47	46.53	62	59.62	59	56.73	62	57.41	62
+	650	60.98	23	21.90	11	10.58	19	16.67	19	17.43	24	23.53	26	25.74	12	11.54	18	17.31	18	16.67	18
++	213	19.98	1	.09			1	.98			1	.98									
Total	1067	105	106	104	114	109	102	101	104	104	108	104	108	108	108	104	104	104	108	108	108
Neck, length																					
ssm	4	.37	1	.95	2	1.75	35	32.11	35	32.11	35	34.31	54	53.47	29	27.62	49	47.12	39	36.11	39
sm	358	33.55	20	19.05	50	43.85	71	65.14	71	65.14	58	56.86	40	39.60	63	60.00	54	51.92	64	59.26	64
+	641	60.07	78	74.29	86	82.69	55	48.25	55	48.25	9	8.82	6	5.94	13	12.38	1	.96	5	4.63	5
++	63	5.90	5	4.76	4	3.85	7	6.14	3	2.75	9	8.82	6	5.94	13	12.38	1	.96	5	4.63	5
Total	1067	105	106	104	114	109	102	101	104	104	108	104	108	108	108	104	104	104	108	108	108
Neck, thickness																					
ssm	4	.37	1	.95	2	1.75	35	32.11	35	32.11	35	34.31	54	53.47	29	27.62	49	47.12	39	36.11	39
sm	358	33.55	20	19.05	50	43.85	71	65.14	71	65.14	58	56.86	40	39.60	63	60.00	54	51.92	64	59.26	64
+	641	60.07	78	74.29	86	82.69	55	48.25	55	48.25	9	8.82	6	5.94	13	12.38	1	.96	5	4.63	5
++	63	5.90	5	4.76	4	3.85	7	6.14	3	2.75	9	8.82	6	5.94	13	12.38	1	.96	5	4.63	5
Total	1067	105	106	104	114	109	102	101	104	104	108	104	108	108	108	104	104	104	108	108	108
Shoulder slope																					
Abs.	30	2.81	1	.94	8	7.02	4	3.67	5	4.95	2	1.90	10	9.35	10	9.35	10	9.35	10	9.35	10
ssm	2	.19	17	16.04	25	24.04	39	34.21	39	34.21	40	39.22	49	48.51	30	28.57	40	38.46	52	48.60	52
sm	347	32.55	78	73.58	72	69.23	60	52.63	60	52.63	50	49.02	34	33.66	59	56.19	61	58.65	36	33.64	36
+	589	55.25	10	9.43	7	6.73	6	5.26	6	5.26	12	11.76	13	12.87	14	13.33	3	2.88	8	7.48	8
++	98	9.19	18	17.14	10	9.43	7	6.73	6	5.26	12	11.76	13	12.87	14	13.33	3	2.88	8	7.48	8
Total	1066	105	106	104	114	109	102	101	104	104	108	104	108	108	108	104	104	104	107	107	107
Chest development																					
ssm	3	.28	7	6.60	9	8.65	11	9.65	12	11.01	15	14.71	14	13.86	10	9.52	8	7.69	12	11.21	12
sm	118	11.07	85	80.19	89	85.58	69	60.53	80	73.39	71	69.61	64	63.37	80	76.19	68	65.38	78	72.90	78
+	759	71.20	14	13.21	5	4.81	34	29.82	16	14.68	14	13.73	23	22.77	15	14.29	28	26.92	16	14.95	16
++	184	17.26	1	.96	1	.96					1	.98									
Total	1067	105	106	104	114	109	102	101	104	104	108	104	108	108	108	104	104	104	108	108	108
Scapulae, vertebral borders																					
Straight	487	45.68	41	39.05	45	43.27	52	45.61	41	37.61	52	50.98	54	53.47	71	67.62	52	50.77	36	33.64	36
Convex	238	22.33	19	18.10	26	25.00	24	21.05	33	30.28	20	19.61	16	15.84	11	10.48	24	23.08	40	37.38	40
Curve	341	31.99	45	42.86	33	31.73	38	33.33	35	32.11	30	29.41	31	30.69	23	21.90	48	46.15	31	28.97	31
Total	1067	105	106	104	114	109	102	101	104	104	108	104	108	108	108	104	104	104	108	108	108
Back, lumbar curve																					
Abs.	45	4.22	1	.95	12	10.53	5	4.59	4	3.92	17	16.83	3	2.85	1	.96	2	1.85	2	1.85	2
ssm	2	.19	28	26.42	37	35.58	51	44.74	49	44.95	44	43.14	64	63.37	74	70.48	67	64.42	57	53.78	57
sm	526	49.30	70	66.04	63	60.58	46	40.35	54	49.54	48	47.06	20	19.80	26	24.76	34	32.68	47	43.92	47
+	463	43.39	8	7.55	4	3.85	4	3.51			6	5.88			2	1.90	2	1.92	2	1.85	2
++	31	2.91	3	2.86	4	3.85	4	3.51			6	5.88			2	1.90	2	1.92	2	1.85	2

Total Series			MEM		DUK		MEJ		HAS		LUM		PUK		MIR		ZAD		MAT		DIB	
#	%		#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Total.....	1067		105		106		104		114		109		102		101		105		104		108	
Abdomen																						
sm.....	216	20.24	16	15.24	19	17.92	25	24.04	25	21.93	24	22.02	27	26.47	18	17.82	14	13.33	23	22.12	23	21.30
+.....	767	71.88	80	76.19	84	79.25	79	75.96	80	70.18	74	67.89	66	64.71	70	69.31	78	74.29	72	69.23	78	72.22
+.....	84	7.87	9	8.57	3	2.83			9	7.89	11	10.09	9	8.82	13	12.87	13	12.38	9	8.65	7	6.48
Buttocks																						
sm.....	345	32.33	26	24.76	6	5.66	22	21.15	48	42.11	26	23.85	49	48.04	58	57.43	42	40.00	31	29.81	34	31.48
+.....	679	63.64	73	69.52	96	90.57	80	76.92	63	55.26	76	69.72	46	45.10	38	37.62	60	57.14	71	68.27	71	65.74
+.....	43	4.03	6	5.71	4	3.77	2	1.92	3	2.63	7	6.42	7	6.86	5	4.95	3	2.85	2	1.92	3	2.78
Calves																						
sm.....	169	15.84	7	6.67			9	8.65	21	18.42	15	13.76	11	10.78	20	19.80	24	22.86	30	28.85	31	28.70
+.....	629	58.95	68	64.76	65	61.32	71	68.27	65	57.02	73	66.97	60	58.82	48	47.52	62	59.05	59	56.73	54	50.00
+.....	258	24.18	28	26.67	39	36.79	24	23.08	28	24.56	21	19.27	27	26.47	31	30.69	18	17.14	15	14.42	23	21.30
+ +.....	11	1.03	2	1.90	2	1.89							4	3.92	2	1.98	1	.95				
Heel projection																						
Abs.....	5	.47											2	1.96	1	.99	1	.95	1	.96		
ssm.....	5	.47											2	1.96	2	1.98			1	.96		
sm.....	667	62.51	74	70.48	57	53.77	61	58.65	69	60.53	75	68.81	74	72.55	68	67.33	62	59.05	62	59.62	58	53.70
+.....	335	31.40	28	26.67	43	40.57	39	37.50	40	35.09	28	25.69	23	22.55	25	24.75	38	36.19	29	27.88	40	37.04
+.....	55	5.15	3	2.86	6	5.66	4	3.85	5	4.39	6	5.50	1	.98	5	4.95	4	3.81	11	10.58	10	9.26
Foot arch																						
Abs.....	7	.66	3	2.86									2	1.96	2	1.98	2	1.90				
ssm.....	3	.28											2	1.96			1	.95				
sm.....	247	23.15	21	20.00	32	30.19	19	18.27	19	16.67	26	23.85	24	23.53	25	24.75	33	31.43	25	24.04	22	20.37
+.....	510	47.80	37	35.24	44	41.51	60	57.69	72	63.16	48	44.04	57	55.88	42	41.58	51	48.57	44	42.31	52	48.15
+.....	294	27.55	39	37.14	30	28.30	25	24.04	23	20.18	35	32.11	19	18.63	32	31.68	18	17.14	34	32.69	34	31.48
+ +.....	6	.56	5	4.76															1	.96		

II. THE FACE

Total.....	1067		105		106		104		114		109		102		101		105		104		108	
Forehead, height																						
ssm.....	6	.56											1	.98	1	.99			1	.96		
sm.....	190	17.81	10	9.52	14	13.21	13	12.50	25	21.93	24	22.02	17	16.67	30	29.70	11	10.48	24	23.08	19	17.59
+.....	714	66.92	74	70.48	76	71.70	78	75.00	82	71.93	64	58.72	70	68.63	55	54.46	79	75.24	70	67.31	63	58.33
+.....	157	14.72	21	20.00	16	15.09	13	12.50	6	5.26	20	18.35	14	13.73	15	14.85	15	14.29	9	8.65	26	24.07
Forehead, breadth																						
sm.....	62	5.81	5	4.76	3	2.83	6	5.77	3	2.63	12	11.01	6	5.88	12	11.88	5	4.76	3	2.88	5	4.63
+.....	708	66.36	58	55.24	78	73.58	86	82.69	79	69.30	80	73.39	78	76.47	47	46.53	78	74.29	62	59.62	56	51.85
+.....	289	27.09	40	38.10	25	23.58	12	11.54	31	27.19	16	14.68	18	17.65	41	40.59	21	20.00	38	36.54	46	42.59
+ +.....	8	.75	2	1.90					1	.88	1	.92			1	.99	1	.95	1	.96	1	.93

Total Series		MEM		DUK		MEJ		HAS		LUM		PUK		MIR		ZAD		MAT		DIB			
#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%		
Total.....		1067		105		106		104		114		109		102		101		105		104		108	
Forehead, slope																							
Forward.....																							
abs.	.84	2	1.90			1	.96	2	1.75			1	.92	3	2.94	2	1.98	1	.95	1	.96	2	1.85
ssm	33	3.09	7	6.67	1	.94	3	2.88	7	6.14	1							2	1.90	3	2.88	4	3.70
sm	8	.75									1	.92	2	1.96	1	.99				1	.96	3	2.78
+	304	28.49	38	36.10	34	23.08	28	26.92	36	31.58	24	22.02	30	29.41	18	17.82	21	20.00	36	34.62	37	34.26	
+	499	46.77	45	42.86	46	43.40	53	50.96	47	41.23	57	52.29	45	44.12	52	51.49	60	57.14	44	42.31	47	43.52	
+	200	18.75	13	12.38	23	21.70	18	17.31	20	17.54	26	23.85	19	18.63	27	26.73	20	10.05	17	16.35	14	12.96	
+	14	1.31			2	1.89	1	.96	2	1.75		3	2.94	1	.99			1	.95	2	1.92	1	.93
Browridges, size																							
sm.....																							
sm	128	12.00	14	13.33	5	4.72	9	8.65	24	21.05	7	6.42	20	19.61	14	13.86	9	8.57	11	10.58	14	12.96	
+	590	55.30	65	61.90	53	50.00	56	53.85	54	47.37	64	58.72	56	54.90	55	54.46	72	68.57	50	48.08	63	58.33	
+	312	29.24	24	22.86	43	40.57	32	30.77	30	26.32	37	33.94	24	23.53	28	27.72	24	22.86	40	38.46	26	24.07	
+	37	3.47	2	1.90	5	4.72	7	6.73	6	5.26	1	.92	2	1.96	4	3.96			3	2.88	5	4.63	
Glabella																							
ssm.....																							
ssm	5	.47																1	.95	2	1.92	2	1.85
sm	140	13.12	14	13.33	5	4.72	10	9.62	24	21.05	10	9.17	22	21.57	17	16.83	9	8.57	11	10.58	16	14.81	
+	590	55.30	68	64.76	54	50.94	56	53.85	57	50.00	63	57.80	53	51.96	55	54.46	72	68.57	50	48.08	61	56.48	
+	299	28.02	21	20.00	42	39.62	31	29.81	28	24.56	35	32.11	26	25.49	26	25.74	23	21.90	38	36.54	25	23.15	
+	33	3.09	2	1.90	5	4.72	7	6.73	5	4.39	1	.92	1	.98	3	2.97			3	2.88	4	3.70	
External eye folds																							
Abs.....																							
abs.	677	63.45	56	53.33	59	55.66	80	76.92	63	55.26	82	75.23	64	62.75	60	59.41	51	48.57	81	77.88	75	69.44	
sm	108	10.12	19	18.10	10	9.43	9	8.65	12	10.53	7	6.42	17	16.67	8	7.92	11	10.48	4	3.85	10	9.26	
+	262	24.56	30	28.57	37	34.91	15	14.42	33	28.95	19	17.43	17	16.67	29	28.71	38	36.19	19	18.27	23	21.30	
+	20	1.87							6	5.26	1	.92	4	3.92	4	3.96	5	4.76					
Eyefolds, epicanthus and median																							
Present.....																							
Present	11	1.03	1	.95	1	.94	1	.96	3	2.63			2	1.96			105	100.00	2	1.92	1	.93	
Absent	1056	98.98	104	99.05	105	99.06	103	99.04	111	97.37	109	100.00	100	98.04	101	100.00	105	100.00	102	98.08	107	99.07	
Palpebral opening																							
ssm.....																							
ssm	14	1.31							5	4.39			2	1.96	5	4.95					2	1.85	
sm	583	54.64	51	48.57	83	78.30	40	38.46	82	71.93	54	49.54	58	56.86	56	55.45	54	51.43	35	33.65	64	59.26	
+	467	43.77	54	51.43	23	21.70	64	61.54	27	23.68	54	49.54	42	41.18	40	39.60	49	46.67	69	66.35	42	38.89	
+	3	.28									1	.92					2	1.90					
Obliquity																							
Abs.....																							
abs.	854	80.04	81	77.14	73	68.87	82	78.85	105	92.11	94	86.24	82	80.39	72	71.29	81	77.14	90	86.54	87	80.56	
ssm	6	.56							2	1.75					3	2.97					1	.93	
sm	189	17.71	21	20.00	32	30.19	19	18.27	5	4.39	15	13.76	16	15.69	24	23.76	23	21.90	14	13.46	18	16.67	
+	18	1.69	3	2.86	1	.94	3	2.88	2	1.75			4	3.92	2	1.98	1	.95			2	1.85	
Malaris, forwards																							
ssm.....																							
ssm	2	.19								.92	1	.98											
sm	483	45.27	48	45.71	37	34.91	34	32.69	54	47.37	43	39.45	51	50.00	49	48.51	45	42.86	56	53.85	62	57.41	
+	534	50.05	55	52.38	60	56.60	64	61.54	56	49.12	55	50.46	45	44.12	47	46.53	59	56.19	44	42.31	44	40.74	
+	48	4.50	2	1.90	9	8.49	6	5.77	4	3.51	10	9.17	5	4.90	5	4.95	1	.95	4	3.85	2	1.85	

Total Series		MEM		DUK		MEJ		HAS		LUM		PUK		MIR		ZAD		MAT		DIB		
#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	
Total		1067	105	106	104	114	109	102	101	105	104	108										
Malars, sideways																						
ssm	6	.56																				
sm	294	27.56	24	22.86	22	20.75	23	22.12	30	26.32	2	1.83	1	.98	2	1.98	39	37.14	33	31.73	26	24.07
+	545	51.08	61	58.10	59	55.66	62	59.62	56	49.12	25	22.94	36	35.29	35	34.65	54	51.43	46	44.23	57	52.78
+ + ...	221	20.71	20	19.05	25	23.58	19	18.27	27	23.68	25	22.94	20	19.61	22	21.78	12	11.43	25	24.04	25	23.15
+ + + ...	1	.09									1	.99										
Checks																						
ssm	4	.37																				
sm	455	42.65	37	35.24	43	40.57	29	27.88	64	56.14	44	40.37	53	51.96	50	49.50	41	39.05	44	42.31	47	43.52
+	533	49.96	58	55.24	54	50.94	70	67.31	41	35.96	57	52.29	40	39.22	44	43.56	58	55.24	53	50.96	52	48.15
+ + ...	75	7.03	10	9.52	9	8.49	5	4.81	8	7.02	7	6.42	8	7.84	6	5.94	6	5.71	7	6.73	9	8.33
Wrinkling																						
Abs.	236	22.12	19	18.10	17	16.04	26	25.00	22	19.30	31	28.44	33	32.35	26	25.74	16	15.24	16	15.38	26	24.07
ssm	4	.37																				
sm	366	34.30	41	39.05	55	51.89	36	34.62	27	23.68	39	35.78	25	24.51	31	30.69	32	30.48	43	41.35	33	30.56
+	385	36.08	40	38.10	28	26.42	39	37.50	52	45.61	30	27.52	35	34.31	31	30.69	49	46.67	38	36.54	43	39.81
+ + ...	73	6.84	5	4.76	6	5.66	3	2.88	10	8.77	9	8.26	8	7.84	11	10.89	8	7.62	6	5.77	6	5.56
+ + + ...	3	.28									2	1.98										
Gonial angles																						
ssm	7	.66																				
sm	270	25.31	25	23.81	29	27.36	25	24.04	22	19.30	1	.92	1	.98	2	1.98	33	31.43	2	1.92	27	25.00
+	591	55.39	57	54.29	61	57.55	65	62.50	74	64.91	69	63.30	46	45.10	51	50.50	49	46.67	53	50.96	60	55.56
+ + ...	190	17.81	22	20.95	16	15.09	12	11.54	16	14.04	22	20.18	22	21.57	16	15.84	23	21.90	20	19.23	21	19.44
+ + + ...	9	.84	1	.95			2	1.92	1	.88			1	.98	2	1.98			2	1.92		
Ear lobes, type																						
Attached	345	32.33	38	36.19	38	35.85	45	43.27	27	23.68	38	34.86	36	35.29	28	27.72	29	27.62	34	32.69	30	27.78
Free	722	67.67	67	63.81	68	64.15	59	56.73	87	76.32	71	65.14	66	64.71	73	72.28	76	72.38	70	67.31	78	72.22
Ear lobes, development																						
ssm	8	.75																				
sm	427	40.02	53	50.48	45	42.45	41	39.42	36	31.58	1	.92	2	1.96	1	.99	35	33.33	2	1.92	2	1.85
+	570	53.42	51	48.57	57	53.77	61	58.65	64	56.14	42	38.53	34	33.33	46	45.54	65	61.90	40	38.46	50	46.30
+ + ...	61	5.72	1	.95	4	3.77	2	1.92	13	11.40	9	8.26	7	6.86	10	9.90	5	4.76	59	56.73	49	45.37
+ + + ...	1	.09							1	.88											7	6.48
Helix																						
Abs.	6	.56	1	.95					1	.88			2	1.96	1	.99					1	.93
ssm	6	.56	1	.95	1	.94	1	.96	1	.88					2	1.98						
sm	314	29.43	32	30.48	32	30.19	44	42.31	31	27.19	29	26.61	26	25.44	24	23.76	17	16.19	41	39.42	35	32.41
+	711	66.64	70	66.67	70	66.04	58	55.77	78	68.42	75	68.81	70	68.63	70	69.31	88	83.81	60	57.69	67	62.04
+ + ...	30	2.81	1	.95	3	2.83	1	.96	3	2.63	5	4.59	4	3.92	4	3.96			3	2.88	5	4.63
Anthelix																						
Abs.	13	1.22	1	.95					1	.88			1	.98			2	1.90	2	1.92	6	5.56
ssm	2	.19																			2	1.85
sm	123	11.53	6	5.71	9	8.49	6	5.77	15	13.16	14	12.84	12	11.76	7	6.93	14	13.33	21	20.19	17	15.74
+	849	79.57	86	81.90	95	89.62	94	90.38	88	77.19	88	80.73	85	83.33	75	74.26	84	80.00	75	72.12	72	66.67
+ + ...	77	7.22	11	10.48	2	1.89	4	3.85	10	8.77	6	5.50	4	3.92	18	17.82	5	4.76	6	5.76	11	10.19
+ + + ...	3	.28	1	.95							1	.92			1	.99						

Total Series		MEM		DUK		MEJ		HAS		LUM		PUK		MIR		ZAD		MAT		DIB	
#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Total	1067	105	106	104	114	109	102	101	105	104	105	104	108								
Darwin's Point, left																					
Abs.	646	70	66.67	60	57.69	64	56.14	71	65.14	57	55.88	49	48.51	63	60.00	69	66.35	67	62.04		
sm	172	19	18.10	23	22.12	17	14.91	15	13.76	22	21.57	18	17.82	15	14.29	7	6.73	13	12.04		
+	220	14	13.33	20	19.23	23	20.18	21	19.27	21	20.59	30	20.70	26	24.76	26	25.00	23	21.30		
++	27	2	1.90	1	.96	9	7.89	2	1.83	2	1.96	3	2.97	1	.95	2	1.92				
+++	2					1	.88														
Darwin's Point, right																					
Abs.	628	68	64.76	57	54.81	59	51.75	65	59.63	59	57.84	59	58.42	62	59.05	63	60.58	61	56.48		
sm	164	16	15.24	23	19.23	17	14.91	15	13.76	22	21.57	11	10.89	15	14.29	12	11.54	10	9.26		
+	246	19	18.10	26	25.00	29	25.44	27	24.77	17	16.67	27	26.73	26	24.76	28	26.92	33	30.56		
++	27	2	1.90	1	.96	8	7.02	2	1.83	4	3.92	4	3.96	2	1.90	1	.96				
+++	2					1	.88											1	.93		
Lips, integumental thickness																					
sm	23	2	1.90	3	2.88	4	3.51	1	.92	1	.98	5	4.95	4	3.81	3	2.88				
+	910	92	87.62	94	90.38	85	74.56	98	89.91	95	93.14	70	69.31	81	77.14	87	83.65	96	88.89		
++	133	11	10.48	7	6.73	25	21.93	10	9.17	6	5.88	26	25.74	20	19.05	13	12.50	12	11.11		
+++	1															1	.96				
Lips, membranous thickness																					
Abs.	93	10	9.52	2	1.92	20	17.54	7	6.42	10	9.80	13	12.87	12	11.43	5	4.81	10	9.26		
sm	19	34	32.38	43	41.35	7	6.14	3	2.75	3	2.75	1	.99	4	3.85	4	3.85	4	3.70		
+	454	60	57.14	57	54.81	41	35.96	38	34.86	49	48.04	51	50.50	42	40.00	58	55.77	46	42.59		
++	469	1	.95	2	1.92	41	35.96	59	54.13	41	40.20	29	28.71	50	47.62	34	32.69	44	40.74		
+++	31					5	4.39	2	1.83	2	1.96	7	6.93	1	.95	3	2.88	3	2.78		
++++	1																	1	.93		
Lips, eversion																					
Abs.	112	10	9.52	5	4.72	20	17.54	9	8.26	10	9.80	16	15.84	15	14.29	14	13.46	11	10.18		
sm	14	33	31.43	44	41.51	7	6.14	1	.92	1	.92	1	.99	2	1.92	2	1.92	2	1.92		
+	453	64	58.10	54	50.94	44	38.60	39	35.78	54	52.94	49	48.51	41	39.05	53	50.96	47	44.52		
++	465	1	.95	3	2.83	40	35.09	58	53.21	38	37.25	30	19.70	49	46.67	33	31.73	43	39.81		
+++	22					3	2.63	2	1.83			5	4.95				1.92		2.78		
++++	1																				
Total	1066	105	106	104	114	109	102	101	104	109	102	101	104	108							
Chin, prominence																					
sm	241	24	22.86	5	4.72	22	21.15	27	23.68	20	18.35	32	31.37	19	18.81	27	25.96	29	27.88		
+	745	76	72.38	90	84.91	79	75.96	75	65.79	80	73.39	60	58.82	70	69.31	73	70.19	67	64.42		
++	79	4	3.81	11	10.38	3	2.88	12	10.53	9	8.26	10	9.80	12	11.88	4	3.85	8	7.69		
+++	1																				
Chin, type																					
Median	813	86	81.90	41	38.68	70	67.31	92	80.70	83	76.15	91	89.22	86	85.15	87	83.65	87	83.65		
Bilateral	253	19	18.10	65	61.32	34	32.69	22	19.30	26	23.85	11	10.78	15	14.85	17	16.35	17	16.35		

Total Series			MEM		DUK		MEJ		HAS		LUM		PUK		MIR		ZAD		MAT		DIB	
#	%		#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Total.....	1067		105		106		104		114		109		102		101		105		104		108	
Nasion depression																						
Abs.....	2	.19																				
ssm.....	68	6.37	9	8.57	3	2.83	4	3.85	10	8.77	7	6.42	5	4.90	8	7.92	1	.95	11	10.58	1	.93
sm.....	320	29.99	26	24.76	30	28.30	29	27.88	38	33.33	34	31.19	20	19.61	29	28.71	3	2.86	36	34.62	8	7.41
+.....	552	51.74	59	56.19	50	47.17	57	54.81	58	50.88	64	58.72	66	64.71	49	48.51	54	51.43	45	43.27	46	42.59
+ +.....	123	11.53	11	10.48	23	21.70	14	13.46	8	7.02	4	3.67	11	10.78	14	13.86	12	11.43	11	10.58	11	10.19
+ + +.....	2	.19													1	.99			1	.96		
Nasal root, height																						
sm.....	114	10.68	10	9.52	8	7.55	11	10.58	3	2.63	6	5.50	14	13.73	22	21.78	18	17.14	13	12.50	8	7.41
+.....	726	68.05	72	68.57	75	70.75	74	71.15	86	75.44	78	71.56	81	79.41	60	59.41	70	66.67	63	60.58	60	55.56
+ +.....	209	19.59	21	20.00	21	19.81	18	17.31	23	20.18	23	21.10	6	5.88	18	17.82	15	14.29	26	25.00	37	34.26
+ + +.....	18	1.69	2	1.90	2	1.89	1	.96	2	1.75	2	1.83	1	.98	1	.99	2	1.90	2	1.92	3	2.78
Nasal root, breadth																						
ssm.....	26	2.44	2	1.90					1	.88	6	5.50	4	3.92	3	2.97	2	1.90	1	.96	7	6.48
sm.....	504	47.24	34	32.38	50	47.17	42	40.38	55	48.25	53	48.62	50	49.02	62	61.39	43	40.95	47	45.19	66	61.11
+.....	494	46.30	59	56.19	52	49.06	58	55.77	56	49.12	46	42.20	41	40.20	36	35.64	55	52.38	55	52.88	30	27.78
+ +.....	43	4.03	10	9.52	4	3.77	4	3.85	2	1.75	4	3.67	7	6.86			5	4.76	1	.96	5	4.63
Nasal bridge, height																						
ssm.....	1	.09			1	.94																
sm.....	46	4.31	4	3.81	5	4.72	6	5.77	2	1.75	4	3.67	5	4.90	4	3.96	8	7.62	5	4.81	3	2.78
+.....	552	51.74	60	57.14	56	52.83	62	59.62	57	50.00	52	47.71	67	65.69	52	51.49	53	50.48	47	45.19	39	36.11
+ +.....	370	34.68	35	33.33	37	34.91	31	29.81	40	35.09	44	40.37	26	25.49	34	33.66	36	34.29	38	36.54	47	43.52
+ + +.....	98	9.19	6	5.71	7	6.60	5	4.81	15	13.16	9	8.26	4	3.92	11	10.89	8	7.62	14	13.45	19	17.59
Nasal bridge, breadth																						
ssm.....	31	2.91	3	2.86					2	1.75	5	4.59	4	3.92	3	2.97	3	2.86	1	.96	10	9.26
sm.....	462	43.30	32	30.48	49	46.23	41	39.42	47	41.23	46	42.20	48	47.06	52	51.49	34	32.38	55	52.88	56	51.85
+.....	519	48.64	58	55.24	51	48.11	57	54.81	62	54.39	56	51.38	42	41.18	45	44.55	63	60.00	47	45.19	32	29.63
+ +.....	54	5.06	12	11.43	5	4.72	6	5.77	3	2.63	2	1.83	8	7.84	1	.99	5	4.76	1	.96	10	9.26
+ + +.....	1	.09			1	.94																
Nasal Profile																						
cnc.....	69	6.47	7	6.67	11	10.38	10	9.62	3	2.63	5	4.59	11	10.78	3	2.97	5	4.76	3	2.88	11	10.19
str.....	416	38.99	40	38.10	47	44.34	47	45.19	45	39.47	44	40.37	42	41.18	40	39.60	36	34.29	39	37.50	33	30.56
cnv.....	571	53.52	55	52.38	48	45.28	47	45.19	66	57.89	60	55.05	48	47.06	58	57.43	64	60.95	58	55.77	62	57.41
c-c.....	11	1.03	3	2.86									1	.98			4	3.85	4	3.85	2	1.85
Nasal tip, thickness																						
ssm.....	31	2.91			2	1.89	2	1.92	4	3.51	4	3.67	3	2.94	3	2.97	2	1.90	4	3.85	7	6.48
sm.....	372	34.87	24	22.86	38	35.85	32	30.77	46	40.35	33	30.28	43	42.16	40	39.60	29	27.62	39	37.50	46	42.59
+.....	548	51.36	57	54.29	52	49.06	62	59.62	57	50.00	64	58.72	46	45.10	53	52.48	62	59.05	46	44.23	42	38.89
+ +.....	115	10.78	24	22.86	14	13.21	8	7.69	7	6.14	8	7.34	10	9.80	5	4.95	12	11.43	15	14.42	12	11.11
+ + +.....	1	.09																			1	.93
Nasal tip, elevation and depression																						
Elevated.....	601	56.36	40	38.10	53	50.00	60	57.69	86	75.44	75	68.81	64	62.75	52	51.49	47	44.76	60	42.31	60	55.56
Depressed.....	466	43.64	65	61.90	53	50.00	44	42.31	28	24.56	34	31.19	38	37.25	49	48.51	58	55.24	44	57.69	48	44.44

Total Series		MEM		DUK		MEJ		HAS		LUM		PUK		MIR		ZAD		MAT		DIB			
		#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%		
Total		1067		106		104		114		109		102		101		105		104		108			
Nasal wings																							
Compressed		383	35.90	25	23.81	33	31.13	23	22.12	54	47.37	30	27.52	46	45.10	41	40.59	33	31.43	43	41.35	53	40.07
Medium		623	58.39	71	67.62	62	58.49	76	73.08	55	48.25	74	67.88	49	48.04	60	59.41	62	59.05	58	55.77	49	45.37
Flaring		61	5.72	9	8.57	11	10.38	5	4.81	5	4.39	5	4.59	7	6.86			10	9.52	3	2.88	6	5.56
Total		1066		106		104		114		109		102		101		105		103		108			
Nasal septum, shape																							
straight		728	68.29	74	70.48	77	72.64	67	64.42	78	68.42	72	66.06	71	69.61	74	73.27	90	85.71	61	59.22	60	55.56
convex		338	31.71	31	29.52	29	27.36	37	35.58	36	31.58	37	33.94	31	30.39	27	26.73	15	14.29	42	40.78	48	44.44
Total		1065		106		104		114		109		102		100		105		103		108			
Nasal septum, inclination																							
Up		596	55.96	43	40.95	57	57.77	64	61.54	82	71.93	72	66.06	59	57.84	52	52.00	49	46.67	57	55.34	58	53.70
Down		469	44.04	62	59.05	49	46.23	40	38.46	32	28.07	37	33.94	43	42.16	48	48.00	56	53.33	46	44.66	50	46.30
Total		1067		106		104		114		109		102		101		105		104		108			
III. THE HEAD																							
Total		1067		106		104		114		109		102		101		105		104		108			
Temporal fullness																							
ssm		2	.19							1	.88												
sm		131	12.28	3	2.86	5	4.72	12	11.54	27	23.68	15	13.76	19	18.63	22	21.78	10	9.52	7	6.73	9	8.33
+		789	73.95	85	80.95	91	85.85	87	83.65	67	58.77	81	74.31	71	69.61	57	56.44	82	78.10	79	75.96	83	76.85
+ + ...		142	13.31	16	15.24	10	9.43	5	4.81	19	16.67	12	11.01	12	11.76	22	21.78	13	12.38	16	15.38	16	14.81
+ + + ...		3	.28	1	.95															2	1.92		
Occipital protrusion																							
Abs.		5	.47	2	1.89															3	2.88		
ssm		21	1.97	1	.95					4	4.39		3.67	2	1.96	3	2.97	2	1.90	2	1.92	2	1.85
sm		341	31.96	43	40.95	26	24.53	25	24.04	42	36.84	14	12.84	19	18.63	32	31.68	47	44.76	51	49.04	41	37.96
+		578	54.17	58	55.24	68	64.15	66	63.46	55	48.25	65	59.63	70	68.63	47	46.53	50	47.62	38	36.54	56	51.85
+ + ...		116	10.87	3	2.86	9	8.49	13	12.50	12	10.53	24	22.02	11	10.78	17	16.83	5	4.76	10	9.62	9	8.33
+ + + ...		6	.56	1	.94					2	1.83			2	2.94	1	1.99	1	.95	1	.96	1	.93
Occipital flattening																							
Abs.		737	69.07	52	49.52	84	79.25	83	79.81	83	72.81	85	77.98	82	80.39	70	69.31	55	52.38	60	57.69	75	69.44
sm		37	3.47	4	3.81	4	3.77			2	2.63	2	1.83	2	1.96	2	1.98	10	9.52	7	6.73	3	2.78
+		213	19.96	35	33.33	14	13.21	17	16.35	17	14.91	17	15.60	9	8.82	20	19.80	30	28.57	30	28.85	23	21.30
+ + ...		70	6.56	12	11.43	4	3.77	4	3.85	10	8.77	5	4.59	6	5.88	8	7.92	9	8.57	6	5.76	6	5.56
+ + + ...		10	.94	2	1.90					1	.88			3	2.94	1	1.99	1	.95	1	.96	1	.93
Lambdoid flattening																							
Abs.		597	55.95	73	69.52	39	36.79	54	51.92	48	42.11	50	45.87	74	72.55	57	56.44	83	79.05	53	50.96	58	53.70
sm		110	10.31	8	7.62	11	10.38	9	8.65	16	14.04	10	9.17	8	7.84	10	9.90	8	7.62	12	11.54	18	16.67
+		327	30.65	21	20.00	54	50.94	40	38.46	39	34.21	47	43.12	18	17.65	29	28.71	13	12.38	35	33.65	30	27.78
+ + ...		31	2.91	3	2.86	2	1.89	1	.96	11	9.65	2	1.83	2	1.96	4	3.96	1	1.95	4	3.85	1	.93
+ + + ...		2	.19													1	.99					1	.93

Total Series			MEM		DUK		MEJ		HAS		LUM		PUK		MIR		ZAD		MAT		DIB	
#	%		#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Total	1067		105		106		104		114		109		102		101		105		104		108	
Hair quantity, cheeks																						
Abs.....	50	4.69	2	1.90	2	1.89	6	5.77	5	4.39	6	5.50	6	5.88	4	3.96	2	1.90	5	4.81	11	10.19
ssm.....	52	4.87			2	1.89	4	3.85	7	6.14	5	4.59	10	9.80	11	10.89	7	6.67	4	3.85	2	1.85
sm.....	189	17.71	13	12.38	18	16.98	15	14.42	23	20.18	20	18.35	18	17.65	19	18.81	20	19.05	29	27.88	14	12.96
+.....	542	50.80	65	61.90	66	62.26	67	64.42	52	45.61	49	44.95	50	49.02	44	43.56	51	48.57	47	45.19	48	44.44
+.....	233	21.84	25	23.81	18	16.98	12	11.54	26	22.81	29	26.61	18	17.65	23	22.77	25	23.81	19	18.27	33	30.56
+.....	1	.09							1	.88												
Hair quantity, jaw																						
Abs.....	21	1.97			2	1.89	4	3.85			5	4.59	3	2.94	2	1.98	1	.95			3	2.78
ssm.....	28	2.62	2	1.90			2	1.92	6	5.26	3	2.75	3	2.94	5	4.95	4	3.81	1	.96	2	1.85
sm.....	183	17.15	5	4.76	15	14.15	15	14.42	20	17.54	18	16.51	23	22.55	20	19.80	15	14.29	34	32.69	18	16.67
+.....	595	55.76	73	69.52	71	66.98	71	68.27	60	52.63	54	49.54	55	53.92	50	49.50	59	56.19	50	48.08	49	45.37
+.....	239	22.40	25	23.81	18	16.98	12	11.54	27	23.68	29	26.61	18	17.65	24	23.76	26	24.76	19	18.27	36	33.33
+.....	1	.09							1	.88												
Hair quantity, arms and legs																						
Abs.....	6	.56									1	.92	1	.98	3	2.97			1	.96		
ssm.....	10	.94					1	.96			2	1.83	3	2.97	3	2.97	1	.95	2	1.92	1	.93
sm.....	280	26.24	12	11.43	18	16.98	24	23.08	26	22.81	31	28.44	36	35.29	33	32.67	24	22.86	41	39.42	34	31.48
+.....	638	59.79	87	82.86	76	71.70	69	66.35	63	55.26	53	48.62	54	52.94	52	51.49	70	66.67	55	52.88	52	48.15
+.....	132	12.37	6	5.71	12	11.32	10	9.62	25	21.93	22	20.18	11	10.78	10	9.90	10	9.52	5	4.81	20	18.52
+.....	1	.09																			1	.93
Hair quantity, chest																						
Abs.....	249	23.34	22	20.95	7	6.60	29	27.88	16	14.04	37	33.94	32	31.37	18	17.82	26	24.76	37	35.58	24	22.22
ssm.....	14	1.30			28	26.42	20	19.23	7	6.14			1	.98	3	2.97	1	.95			2	1.85
sm.....	245	22.96	14	13.33	55	51.89	46	44.23	26	22.81	25	22.94	27	26.47	23	22.77	28	26.67	29	27.88	25	23.15
+.....	378	35.43	48	45.71	55	51.89	46	44.23	41	35.96	26	23.85	33	32.35	39	38.61	31	29.52	25	24.04	30	27.78
+.....	170	15.93	21	20.00	15	14.15	9	8.65	19	16.67	21	19.27	8	7.84	16	15.84	19	18.10	12	11.54	26	24.07
+.....	11	1.02			1	.94			5	4.39			1	.98	2	1.98			1	.96	1	.93
Whiteness, head																						
Present.....	10	.93							2	1.75	5	4.59							1	.96	2	1.85
Absent.....	1057	99.06	105	100.00	106	100.00	104	100.00	112	98.25	104	95.41	102	100.00	101	100.00	105	100.00	103	99.04	106	98.15
Whiteness, mustache																						
Present.....	7	.65							2	1.75	5	4.59										
Absent.....	1060	99.34	105	100.00	106	100.00	104	100.00	112	98.25	104	95.41	102	100.00	101	100.00	105	100.00	104	100.00	108	100.00
Grayness, head																						
Abs.....	690	64.67	73	69.52	80	75.47	79	75.96	51	44.74	74	67.89	69	67.65	57	56.44	65	61.90	76	73.08	62	57.41
ssm.....	25	2.33	1	.95					6	5.26			4	3.92	8	7.92	1	.95	3	2.88	2	1.85
sm.....	117	10.97	12	11.43	13	12.26	12	11.54	16	14.04	13	11.93	7	6.86	10	9.90	11	10.48	7	6.73	15	13.89
+.....	140	13.12	11	10.48	7	6.60	8	7.69	18	15.79	14	12.84	17	16.67	16	15.84	17	16.19	11	10.58	17	15.74
+.....	78	7.31	6	5.71	5	4.72	5	4.81	19	16.67	6	5.50	4	3.92	8	7.92	8	7.62	6	5.77	11	10.19
+.....	17	1.58	2	1.90	1	.94			4	3.51	2	1.83	1	.98	2	1.98	3	2.86	1	.96	1	.93
Grayness, mustache and beard																						
Abs.....	775	72.63	78	74.29	87	82.08	88	84.62	73	64.04	83	76.15	76	74.51	65	64.36	65	61.90	84	80.77	70	64.81
ssm.....	4	.37	1	.95					1	.88	1	.92			1	.99						
sm.....	83	7.78	6	5.71	8	7.55	3	2.88	7	6.14	7	6.42	6	5.88	10	9.90	15	14.29	8	7.69	11	10.19
+.....	130	12.18	15	14.29	7	6.60	9	8.65	18	15.79	9	8.26	15	14.71	15	14.85	18	17.14	8	7.69	15	13.89
+.....	64	6.00	4	3.81	4	3.77	4	3.85	13	11.40	7	6.42	3	2.94	8	7.92	6	5.71	3	2.88	12	11.11
+.....	11	1.03	1	.95					2	1.75	2	1.83	2	1.96	2	1.98	1	.95	1	.96		

Skin Color																				
Total	1067	105	106	104	114	109	102	101	105	104	108									
Light	977	91.57	105	100.00	101	95.28	100	96.15	91	79.82	99	90.83	92	90.20	86	85.15	100	95.24	94	90.38
Medium	83	7.78	0	0.00	5	4.72	4	3.85	22	19.30	8	7.34	8	7.84	14	13.86	4	3.81	10	9.62
Dark	7	.66	0	0.00	0	0.00	0	0.00	1	.88	2	1.83	2	1.96	1	.99	1	.95	0	0.00
Vascularity																				
Total	1066	105	106	104	113	109	102	101	105	104	108									
Abs.	18	1.69	1	.94	2	1.92	5	4.90	5	4.95	2	1.90	1	.96	1	.93				
ssm	1	.09				1	.92	1	.98											
sm	207	19.42	21	20.00	10	9.43	22	21.15	22	19.47	22	20.18	21	20.59	33	32.67	20	19.05	18	17.31
+	711	66.70	70	66.67	95	89.62	78	75.00	52	46.02	74	67.89	65	63.73	53	52.48	69	65.71	73	70.19
+	128	12.01	14	13.33	2	1.92	39	34.51	12	11.01	9	8.82	9	8.82	10	9.90	14	13.33	12	11.54
+	1	.09					1	.98					1	.98					13	12.04
Hair color, head																				
Total	1030	105	106	103	96	102	102	101	105	102	99									
Black	423	41.07	40	38.10	22	20.75	42	40.78	59	61.46	46	45.10	40	39.22	53	52.48	43	40.95	32	31.37
Dark brown	476	46.21	47	44.76	70	66.04	54	52.43	22	22.92	47	46.08	54	52.94	35	34.65	49	46.67	53	51.96
Red brown	16	1.55	1	.95	4	3.77	1	.97	1	1.04			1	.98	1	.99			5	4.90
Light brown	90	8.74	14	13.33	7	6.60	4	3.88	7	7.29	6	5.88	6	5.88	11	10.89	13	12.38	11	10.78
Ash-blond	2	.19			1	.97	1	.97											1	1.01
Golden	21	2.04	2	1.90	3	2.83	1	.97	6	6.25	3	2.94	1	.98	1	.99			1	.98
Red	2	.19	1	.95					1	1.04									3	3.03
Hair color, mustache																				
Total	1054	105	105	103	109	105	102	101	105	104	106									
Black	65	6.17	4	3.81	3	2.86	9	8.74	8	7.34	9	8.57	7	6.86	10	9.90	3	2.86	6	5.77
Dark brown	277	26.28	35	33.33	39	37.14	42	40.78	22	20.18	29	27.62	29	28.43	24	23.76	15	14.29	25	24.04
Red brown	376	35.67	36	34.29	41	39.05	23	22.33	30	27.52	34	32.38	25	24.51	42	41.58	49	46.67	41	39.42
Light brown	195	18.50	19	18.10	11	10.48	19	18.45	24	22.02	20	19.05	13	12.87	23	21.90	17	16.35	18	16.98
Ash-blond	4	.38	1	.95	1	.95	1	.97	1	.98	1	.98	1	.98		.94			1	.94
Golden	103	9.77	7	6.67	4	3.81	6	5.83	20	18.35	12	11.43	8	7.84	5	4.95	10	9.52	14	13.46
Red	34	3.23	4	3.81	6	5.71	3	2.91	5	4.59	1	.95	2	1.96	7	6.93	5	4.76	1	.96
Eye color																				
Total	1067	105	106	104	114	109	102	101	105	104	108									
Black	1	.09	1	.94																
Dark brown	144	13.50	7	6.67	25	23.58	24	23.08	8	7.02	19	17.43	13	12.75	15	14.85	6	5.71	9	8.65
Light brown	32	2.98	2	1.90	2	1.96	1	.96	2	1.75	2	1.83	1	.98	2	1.98	2	1.90	1	4.81
Dark light brown	1	.09																	1	.96
Gray brown	537	50.33	52	49.52	57	53.77	56	53.85	55	48.24	55	50.46	53	51.96	40	39.60	56	53.33	55	52.84
Gray brown	80	7.50	9	8.57	4	3.77	5	4.81	11	9.65	4	3.67	10	9.80	17	16.83	5	4.76	12	11.54
Black brown	204	19.12	27	25.71	14	13.21	11	10.58	26	22.81	20	18.35	20	19.61	23	22.77	30	32.97	13	12.50
Gray	1	.09														.96			1	.96
Gray blue	2	.19														.96			1	.96
Blue	64	6.00	8	7.62	5	4.72	6	5.77	11	9.65	9	8.26	5	4.90	3	2.97	6	5.71	7	6.74
Unlike	1	.09			1	.96	1	.96	1	.88									4	3.70

[illegible]

PHYSICAL ANTHROPOLOGY STUDIED BY PROBLEMS: AGE, FUNCTION, ENVIRONMENT, AND HEREDITY

WHEN the earlier version of this report was written it followed the then usual scheme of dealing first with measurements of the body, then indices derived from the same, then with measurements and indices of the head and face, and finally with observations. It followed the order of the measurement blank, which had been made up for speed and convenience in measuring. Speed and convenience in measuring are important in the field, but in the statistical laboratory their utility ceases. The criteria measured and observed exist only to give us evidence by means of which problems may be solved. The order of subjects to be explored, therefore, should be patterned on problems, rather than on classes of criteria.

The chief problem of the present study is: *What is the racial position of these Mountain Gbegs*, whose environment we have described and whose cultural history we have traced?

The study of race is a study of one department of *heredity*, or genetics, subject to certain controls. These controls are breeding habits, sex, age changes, function, and environment. We have already explored the breeding habits of the population exemplified by our statistical sample. We know in large measure whence came the ancestors of these people, and at what times, and how these mountaineers have regulated their matings from the time of their arrival to the present. As human populations go this material is well documented.

A gene is best described as a capacity for performance. The extent to which this capacity is reached in the organism is a function of a number of factors. One is *sex*. This means simply one should not include both males and females in the same series. Differences between males and females in anatomical and physical characters may be racial. In the present sample we had to forego the measurement of females for reasons of expediency. Another is *age*. The organism changes throughout life; the body grows from birth

to maturity, and then certain parts of it shrink again with senility. Different parts of the body grow at different rates. The long bones cease to grow after their epiphyses have fused, and the bones of the skull after the sutures have closed. However, the bones of the face keep on growing sagittally, at a reduced rate throughout life. Changes in the measurements of bony areas in the living are caused, in the adult, by changes in the thickness, elasticity, etc., of the soft parts which surround and fit between them.

In the male hair appears on the face after puberty, and in many cases disappears later from the top of the head. Graying sets in, and if one lives long enough the hair will ordinarily become white. The teeth erupt at different times and in a regular order. Age changes in man are not as drastic as in insects, which go through larval and adult stages, but they are quantitatively great enough to upset comparisons between samples if they are not controlled. They are genetic in the sense that *rates of change* in many characters seem to be inherited. These rates may, however, be altered by extreme conditions of function and environment, and hence the whole problem of ageing in man is not a simple one.

A third factor is *function*. Function is essentially the operation of the organism, or its motion. This motion may be defined as the sequence of regular and repetitive changes in the organism which result from the expenditure of energy on the scale of time within the limits of a state of equilibrium. When these limits are breached the regularity and repetitive character of the motions cease. The organism, no longer an autonomous entity, is dead. As with age, body functions are in part genetically operated, since each individual inherits capacities for their performance. As with age again, they are partly subject to the limitations of environment, which gives them the material to work with. And further, they are subject to changes with age.

Washburn has shown¹ that the size and shape of some anatomical characters are dependent on use. By removing one jaw muscle of rats, he observed that the bony structure changes asymmetrically in response. Many of our anatomical characters which most physical anthropologists have long considered purely racial in the genetic sense are in fact subject to functional limitations. This may be seen mostly clearly in the jaws and teeth, since one of the most varied of human anatomical functions is *eating*. Variations in eating habits are environmental (in terms of available food-stuffs) and cultural (in terms of bringing exotic foods from other regions and of food preparation in general). Although one may separate environment from culture for other purposes, from the standpoint of what they do to the body, they are one.

The term *capacity for performance* implies function, primarily, and anatomy, in a derivative sense. Our present data are almost wholly anatomical. It would be far more satisfactory to have data on a balanced combination of both functional and anatomical characters—representing motion and the product of motion. More recently collected samples from other areas include extensive data on the different kinds of blood groups: the *O*, *A*, *B*, *AB* sequence (the only one known at the time of my investigation); the many subdivisions of *A*; the *m*, *n*, *mn* series, with subdivisions; the rhesus group, and others which are being studied momentarily. As these categories increase, blood grouping becomes increasingly useful. Unfortunately this present study will have to do without it. I did not take blood samples for the *O*, *A*, *B*, *AB* series because the Mountain Ghegs attach much ritual significance to blood-letting, even in small quantities. Had I tried to take a little of theirs, they might have drained off much of mine. The risk of losing the entire series, and my life as well, did not seem to justify such an attempt.

Although anatomical characters may be derivative, they are also selective, and this introduces our fourth factor, *the environment*. It is our anatomy which we expose to the rigors of the environment and which therefore

qualifies our capacities to function. Since these functions are subject to selection, so is anatomy, and anatomy may be the deciding factor. For example, resistance to disease is functional and in large measure hereditary.² A specific disease, tuberculosis, has greater success in long narrow lungs than in more nearly globular ones. Long narrow lungs are found in long narrow bodies, and more globular lungs in more globular bodies. In regions where exposure to tuberculosis is critical, there will be a selection for stockier, deeper chested body types. Over the million years or more of man's existence as a two-legged, talking, fire-using primate, he has been exposed to enough selective forces to account for all the anatomical changes visible in human races as they exist today. Anatomy is an end product, resulting from the effect of outside forces on body functions; but the anatomy itself qualifies function, and hence it plays an active as well as a passive role. The current fashion of slighting anatomy in the study of race is shortsighted.

In our series there are 2 principal ways that environment can affect anatomy. One is through nutrition. As we have seen, the Gheg mountaineer lives on the produce of the soil in his immediate neighborhood, and these soils vary. Hence we have an excellent chance to study the effect of differential nutrition on anatomy in segments of a genetically related population. Another is through cultural habits, in particular the habit of cradling infants. This in turn may be qualified by differences of nutrition. Here we are at the heart of the Dinaric problem, the question to which this study is devoted.

Once we have taken into account and quantitatively evaluated the various results of age, function, and environment, we are left with a number of qualified anatomical characters, which until proven otherwise can be called hereditary. Then we can see whether or not the area is a racial unit, and how its population and those of its subareas, if any, fit into the general human and specifically European racial scheme.

We are faced, therefore, with the following problems:

¹ Washburn, 1947.

² See Coon, Garn, and Birdsell, 1950.

- a. What are the anatomical peculiarities of these Ghegs whom we have measured?
- b. To what extent are the constants which we have determined dependent on age?
- c. Has the function of the jaw, including manner and amount of chewing, any effect on the size and shape of the masticatory apparatus?
- d. Have differences in soil and hence nutrition anything to do with body size and proportions?
- e. Has the Gheg practice of cradling infants produced any effect on head and face form?
- f. What is the racial position of our sample, once these last 4 potentially qualifying factors have been controlled?

In each of the next 5 chapters, one of these problems will be considered.

THE MOUNTAIN GHEG PHENOTYPE

THE SERIES AS A WHOLE

I. The Body

OUR 1067 Gheg mountaineers range from the metric equivalent of 4 feet, 5 inches to 6 feet, 4 inches, with a mean at approximately 5 feet, 7 inches (169.7 cm.). This mean falls on the borderline between *medium* and *tall* in the standard classification of Martin.¹ For Europeans, they are tall. They are taller than most Tosks, although regional Tosk populations may turn out to be as tall. They are shorter than the Montenegrins and Bosnians immediately north and northwest of them, and about the same as the Dalmatians and the taller of the Tyrolese. Aside from their northern neighbors, only the Ukrainians, Scandinavians, and British are consistently taller among European populations. Native-born Americans are also taller.

The rather limited set of body measurements and indices available indicates a normal European position, but a little on the long-limbed and lanky side. In shoulder breadth, span, bi-iliac, sitting height, and derivative indices which relate to stature, these mountaineers resemble the Scandinavians and British more closely than the stockier central and eastern Europeans. Finding it impossible to persuade the majority of my subjects to maintain an "at rest" position while I was measuring their chest diameters, I measured them at full inspiration, and hence the figures are much higher than those of other series. I believe that most of these men had well-developed chests, as studied by any technique.

The 12 observations on body form give a more detailed if less objective picture (see table 4). The mean point is supposed to represent a hypothetical norm for Europeans. The general musculature is just about average; variation is not great. Necks are medium to short, and medium to thin; shoulders are on the square side of medium, chests a little larger than average. The back is unusually straight, with little lumbar curve; the abdomen rarely

prominent, the buttocks medium to small, the calves well developed, the heels a little more projecting than expected, the foot arch about medium. This is a picture of an average man who has led an active out-of-door life in a hard but healthy environment, on a minimum of food which is nevertheless well balanced; he is muscular, lean, and accustomed to walking long distances over rough terrain. From the neck down it would be hard to distinguish him from a shepherd in the Scottish Highlands, a Norwegian from the fjord country, or an Appalachian mountaineer.

Only one physiological test was made: dynamometer squeeze. Despite the cold weather, despite the stiffening of fingers through years of ploughing, the mountaineers produced a mean of 112 pounds, ranging from 45 to 190 (see table 9).

II. The Face

From the neck up the resemblance to Scot and Norwegian would continue in most respects, but would disappear in others. In the more noticeable dimensions of the face it would be quite close. The Albanian mountaineers have moderately long faces, both in the distance from nasion to alveon (the point on the gums between the 2 upper median incisors) and from nasion to menton. It is hard to make close comparisons because individual anthropometrists vary greatly in locating these points. Comparing them with series of which one can be moderately sure that the same techniques were used, we see that the Ghegs are about the same in face length as populations which are predominantly Nordic or which represent the larger varieties of Mediterranean—like the English, the Riffians, and the Basques, and shorter faced than populations with an excess of marginal pre-Neolithic genetic elements, like the Irish and Norwegians. They are longer-faced than the small Mediterranean peoples like Spaniards and southern Italians. The upper face is relatively long in proportion to the total face height; this is usually, in Euro-

¹ Martin, 1928, vol. 1, p. 255.

pean populations, found among peoples who are predominantly Mediterranean in type, but not very different from the situation in some populations usually considered Nordic.

The minimum frontal diameter, the only measurement usually taken of the forehead, is another troublesome criterion from the technical standpoint. Variations in technique between anthropometrists render most comparisons specious. Using only series which we know to be comparable, one can easily see that the Ghegs, with a mean of nearly 109 millimeters, are broader in this dimension than the long-faced Europeans to whom they are also similar in stature and body build; most of the Mediterranean and Nordic series run to 102–106 millimeters. In the bizygomatic, which is difficult to get wrong, they are again more comparable to the larger and broader-faced European populations. Here they fit in with the larger-faced local populations of Norway and Ireland, and exceed standard Nordics and Mediterraneans. In the bigonial, however, this excess is much smaller. As a result the typical Gheg face, like that of the traditional Basque, looks like an equilateral triangle set on its apex (*frontispiece*).

The nose height of the Ghegs is exceeded by few in Europe, or in the world. Several factors contribute to this position, including the fact that the nasal septum and tip among the older men were so depressed that age changes of the soft parts must have played a conditioning role in my measuring. At the same time the nose breadth is among the narrowest in Europe and the world, and the nasal index is extremely leptorrhine.

The ratio between forehead and face breadths (zygo-frontal) is high in all Dinaric series, the Ghegs included; it reflects the unusual width of the forehead. The zygo-gonial is even higher, for the same reason, coupled with the fact that the bigonial diameter is relatively less than the bizygomatic. The facial index of the present series falls on the borderline between Martin's categories of mesoprosopic and leptoprosopic—although the Gheg faces are large, their length-breadth proportions are moderate. This is not true of the nose, which has one of the lowest nasal indices on record, placing it in the hyperleptorrhine category.

Thirty-eight observations piece out this picture. Impressions of the foreheads of 1067 men show them to be for the most part of medium height and a little more than medium breadth, with a little less than medium slope on the average. The browridges run moderately large, and glabella is usually prominent. Eye-folds are usually absent, but when they do occur are almost always external, the so-called "Nordic" fold which is common with all narrow-faced Europeans. The almost complete absence of median and internal folds differentiates these people sharply from the Mongoloid and east Baltic populations of northeastern Europe. The wide opening of the eyeslit further emphasizes this difference. Almost one individual out of five shows a little eye obliquity, reminding one of Near Eastern Mediterranean types.

The face itself is characteristically gaunt; the malars rarely protrude forward and their lateral extension is only medium. The cheeks are medium to thin, and usually wrinkled, with firm lines around the mouth. The gonial angles protrude only to a normal extent judging by ordinary western European standards. This lean, drawn, and weather-beaten appearance of the face heightens the resemblance of these people to the Scots, Norse, and Basques. The 5 observations on the ears show nothing uncommon for Europeans. The lips run a little above medium in integumental (muscular) thickness, and unusually thin in membrane, reflecting probably bite and eating habits as much as race; they are also less everted than in the normal run of familiar European whites. The lips of the Ghegs look more like those of family portraits of the Revolutionary period than like those of modern Americans. The observation on chin prominence is based on actual slope rather than on fidelity to an ideal mean; the presence of 23 per cent of *sm* chins is no greater than would be found in any other narrow-jawed European population. Most of the chins are median; the bilateral form (discovered through palpation) goes with the Alpine and other pre-Mediterranean types in Europe as well as with individuals of unusual robusticity.

The most distinctive feature of the Mountain Gheg face, the nose, almost never springs from glabella without depression, according to

the Greek ideal. Although not unusually high, its root is exceptionally narrow. Its bridge is usually both high and narrow. This combination yields a high frequency, in fact a majority, of convex nasal profiles, giving the Gheg his traditional hawklike appearance. The tip of the nose is medium to thin, more often straight or elevated than depressed, with medium to compressed wings and usually a straight septum. This nose, as the forward segment of a gaunt, triangular face, gives the classical Dinaric his impressive facial appearance.

III. The Head

So far we have found only a few measurements and observations to differentiate the ordinary Gheg mountaineer from the shepherd of the Scottish Highlands, the Basque, and the inland Norwegian to whom we first compared him. When we remove his felt cap, however, and study his head, we find that the resemblance ceases. His head is 10 whole millimeters shorter than those of his Atlantic-bordering simulacres, resembling in this respect eastern and central European peoples, and the inhabitants of Armenia, Anatolia, parts of the Caucasus, and the Lebanon. At the same time it is much broader, in fact it is among the broadest heads in Europe. It is difficult to find its exact position regarding height, since head height is notoriously subject to the personal equation. Judging by only those series of which I am sure, I consider the Gheg heads moderately to more-than-average elevated. They do not, however, reach the extremes in this dimension that they do in length and breadth. In the indices of the head, these people are fully brachycephalic, although less extreme in this respect than some of their neighbors, notably the Tosks and some of the mountain-dwelling Yugoslavs, among whom mean indices of 87 and 88 have been recorded. In the length-height indices they rank as hypsicephalic, while in the breadth-height index they take a low position. This merely reflects the moderate head height in comparison with an extreme cranial breadth. The indices which serve to compare the parietal breadth with facial diameters—fronto-parietal and cephalo-facial—both emphasize the disproportion between a very broad hind-head and moderate facial breadths. The fronto-parietal and cephalo-facial indices, relating the forehead

and face breadths to that of the rear segment of the head are low, but not unusually so, because the forehead and zygomatic arches are also somewhat wider than the thin appearance of the face would lead one to suspect.

We have seen already that the forehead tends to be a little straighter, or less sloping, than with most of the hawk-visaged non-Dinaric European peoples; this fullness of the forehead is matched by a correspondingly well-developed temporal fullness. At the rear, however, the skull shows a tendency for less than the normal degree of occipital protrusion, and in 31 per cent of individuals the occiput is actually flattened. An even greater ratio, 44 per cent, show flattening in the lambdoid region, and in 29 per cent of cases we find the anomaly known as bathrocephaly, which is a failure of the parietal bones to unite smoothly with the occipital at lambda, with a shelf or depression at the critical point, reminding one of a softball that has been knocked lopsided and started to come unstitched. The back of the head is clearly the most unusual and hence interesting portion of the Gheg anatomy. The same would be true of course in the case of Dinarics and Armenoids from other countries.

A further fact that seems highly suggestive is that 36 per cent of our subjects (most of whom, as we shall see later, possess some kind of flattening) have noticeably asymmetrical skulls. Were this asymmetry a normal variant from the usual condition, one would expect more individuals in the *sm* than in the *plus* categories, but this is not the case; asymmetry itself seems to have a normal distribution wholly aside from the absent category. Furthermore, it is 2.4 times as frequent on the right as on the left side, which suggests a functional association. Facial asymmetry, on the other hand, is very rare, accounting for only 6 per cent of the whole, and without significant distinction between right and left. Handedness was determined by asking the men to pick up a stone, by tossing them a stick, etc. Most were illiterate, and the choice of hand for eating was dictated by custom. The 7.6 per cent of left handed and ambidextrous is undoubtedly far too low a number—conditioning probably affected catching, throwing, and picking things up to a certain extent too. The ratio shown by the cranial asymmetry is probably nearer the truth genetically.

IV. The Pilous System

The eyebrows of the Gheg mountaineers are close to the European norm, if such a position can be postulated; perhaps they are a little thicker and more concurrent than those of most northern and western populations, but if so the variation is slight. Thirteen more observations show that the Dinaric race as exemplified by these Ghegs is equally normal by European standards. It was not easy in each case to determine hair form. Some men wore scalplocks, and others let the back hair grow long, but others shaved their heads, and if they had done this recently and lacked long mustaches, my estimate was correspondingly less accurate. It is possible that more should for this reason be in the *straight* category, but not many more. Slightly wavy hair is characteristic, and it is of medium to fine texture. Straight coarse hair such as one finds among Mongoloids and many Eastern Europeans is virtually lacking, and curly hair rare. Baldness is rare, particularly considering the age of the sample (of which more later). The thickness of the head hair (in the case of bald men this is observed on the part of the scalp which still has hair) is about medium, while the face hair, including mustache, cheeks, and jaw, are probably a trifle heavier than with northern and eastern Europeans, although not equalling the development of the Alpine population of Bavaria and parts of France. Luckily most men wore luxuriant mustaches and shaved their beards infrequently. Despite their age these mountaineers seem to have had slightly less hair on their limbs and chests than expected in view of their beard growth. One is reminded of a normal Nordic and Mediterranean development rather than that of Alpines. The number of men with fully white hair or beards was negligible; grayness of the head was more prevalent than that of the mustache and beard. In most cases, however, it was possible to tell the color of the still pigmented hairs.

V. Pigmentation

Skin color was observed on supposedly unexposed surfaces of the under arm and chest. The vast majority were about the same as the examiners—a pinkish white approximating von Luschan #7. The others were brunet white, in no case darker than one expects to find

among Greeks or Italians. Almost all possessed the pink or red vascular flush that comes to light, thin skin with outdoor living. Since the measuring was done in the dead of winter, either out of doors or in chilly houses, and since many of the men were inadequately dressed, their rosiness is not surprising.

About one of 9 men had hair that could be called blond or red; of the rest little more than a half were brown haired, and the others black. *Dark brown* included many who might better have been labeled *brown* without further qualification. The mustaches were much lighter; dark and red browns are the rule, while light browns, extreme blonds, and reds come to nearly a third of the whole. Only one-sixth of the sample had pure dark iris pigment, but the number of pure blues and grays was only half as great as that. A three-fourths majority had eyes that were mixed in color, and of these the light mixtures predominate. The prevalence of mixed eye types is reflected in the ratios of rayed, zoned, and spotted irides.

In their pigment characteristics the Mountain Ghegs are about half way between blond and brunet pigment extremes as delimited by the European range; they run to light skins, dark head hair, and intermediate to light mustaches with much red, and a light mixed eye color. In pigmentation they are not very different from the Highland Scots, the Basques, and the Kentucky mountaineers—but considerably darker than the Norwegians. They are fairer than the Italians of the portions of Italy opposite them, and fairer than Tosks, Greeks, Bulgarians, and Serbs, while probably little different from Montenegrins, Bosnians, and Tyrolese.

The Gheg phenotype is thus represented by a moderately tall man, long limbed, strong boned, well muscled, spare and lean, with a thin, bony face of moderate dimensions, a long, narrow, aquiline nose, a short, broad head, often flattened behind, a well-developed mustache and beard, both of which vary in color, a light skin, and mixed eyes. His body hair is only moderately developed. In all characters except those concerned with the breadth and flattening of the head he resembles the Nordic and larger Mediterranean populations of the fringes of Europe more than the stockier, flatter-nosed, and hairier peoples in its east and center. If

one could compare a series of skeletons of such men with those from the Illyrian Iron Age cemetery at Glasinac, it is hard to see what differences between the means would appear except for the greater frequency of broad, and often occipitally flattened, heads in the living population.

VARIABILITY OF THE SERIES AS A WHOLE AND OF THE TRIBES

Any living population may be expected to show a normal frequency distribution in each metrical criterion. This distribution is expressed by the standard deviation (see table 3B). Standard deviations themselves vary. If the standard deviation exceeds a certain nu-

degree of variability. In one character, the nasal index, they possess a remarkable homogeneity. In stature, head length, head breadth, and the cephalic index, they show a greater variability than might be expected from a normal unit population. This is particularly marked with the cephalic index. Thus, using variability as our criterion, we find that *the Mountain Ghegs are a population as far as the diameters and proportions of the face are concerned, but not when stature and the dimensions and form of the cranial vault are considered.*

If they are not a population, then they are a compendium of populations, which may or may not be the tribes. In most criteria the tribes show a range of variation on either side

TABLE 5: σ RATIOS.

	HOWELLS'												
	σ	TOTAL	MEM	DUK	MEJ	HAS	LUM	PUK	MIR	ZAD	MAT	DIB	TRIBES
Stature	5.81	116	107	107	95	125	102	110	100	109	107	117	108
Head lgth.	6.23	114	112	97	117	106	105	117	108	97	110	111	108
Head br.	5.24	115	108	97	112	135	105	105	112	106	111	98	109
Min. frontal diam.	4.88	100	96	86	95	104	98	99	93	102	111	93	98
Bizyg. diam.	5.28	107	119	110	140	104	94	108	92	117	110	102	110
Bigon. diam.	5.79	106	107	97	104	112	95	111	102	107	104	102	104
Total face ht.	6.43	101	108	99	109	96	86	99	89	105	103	91	98
Upper face ht.	4.66	107	107	101	110	104	101	94	99	107	115	113	105
Nasal ht.	3.77	111	110	102	107	117	114	99	108	109	114	103	107
Nasal br.	2.92	95	105	102	81	112	94	98	100	104	101	93	99
Cephalic index	3.39	127	115	108	127	135	124	118	119	106	123	119	119
Cephalo-fac. index	3.51	99	98	96	97	93	95	102	85	91	99	108	96
Facial index	5.09	99	111	94	104	98	84	99	78	100	103	82	96
Upper fac. index	3.63	100	101	95	98	110	89	89	82	92	105	106	97
Nasal index.	7.82	77	81	79	70	78	66	82	72	81	86	73	77

merical value, one is led to suspect that the series includes individuals from not one, but several populations, which differ from each other in the criteria concerned.

In order to provide an easy test for this, Howells² has compiled a table of means of standard deviations for a large number of series, each of which consists of over 50 individuals; he has likewise devised the "sigma ratio," to compare individual sigmas with the mean. Table 5 shows how this may be applied to our Albanian material. In most of the measurements and indices of the face, our Mountain Ghegs possess, as a whole, a normal

of the 100 mark; in the nasal index all fall far below; in the cephalic index all fall far above. The nose height is always more variable than Howell's mean, and tribal variations in the cephalic index reach remarkable heights. From this we may deduce that *the variation in stature is due to the regional size differences which we have already seen, that the variation in cephalic index is due to some factor operating within tribes as well as between them, while the extraordinary homogeneity in nasal index is connected with a great variability in the nose height, which varies with the nose breadth instead of independently.*

² Howells, 1936, pp. 592-600.

It is conceivable that the tribes themselves differ in amount of variability. In order to test this let us turn to table 3c. If we average the values of *V* for 32 characters, from stature to nasal index, we obtained the following (see table 6).

TABLE 6: VALUES OF *V* FOR 32 CHARACTERS, BY TRIBES.

	Mean <i>V</i> .
Total series	5.26
Mean of tribes.....	5.09
McM	5.13
Duk	4.95
McJ	4.95
Has	5.37
Lum	4.84
Puk	5.14
Mir	4.97
Zad	5.14
Mat	5.32
Dib	5.11

As a whole, the tribes are less variable than the total series. Only 2 tribes, Has and Mati, form exceptions to this rule. The Has sample was taken from a single locality, the Mati one from a widespread and religiously diverse population. But even with them only one coefficient of variation is *significantly* greater than its mate in the total series: Has is more variable in head height than the total series by 4.71 times p. c.

Four tribes are notably less variable than the whole; Luma, Dukagin, Malsia e Jakovës, and Mirdita. *Two of these are our only 100 per cent Catholic tribes, noted for their genetic isolation.* On this basis their relative homogeneity is understandable. But Luma and Malsia e Jakovës are mostly or wholly Moslem, and situated on the main traffic routes. How do they differ from the others? The answer, which forms part of the next section, is simple: *they are the least brachycephalic of all the tribes.* It is in the area of the cranial vault that much of our tribal differentiation lies.

³Elaborate tables have been prepared to show the significance ratios of the differences between means of all metrical characters of all tribes, and the same for all categories of percentages in the observations. The cost of publishing such tables is prohibitive. In the

PHENOTYPICAL DIFFERENCES BETWEEN TRIBES; STATISTICAL VALIDATION

Let us examine the geographical distribution of anthropometric characters among the tribes. We must not forget that the total area is no larger than Connecticut, that the population of this miniscule region has seen no foreign invasions, no infiltrations or immigrations, for at least 400 years, and that it may be derived historically from a single known source. Under ordinary conditions one would not expect to find wide physical differences. But the conditions in Malsia e Ghegnisë are not ordinary. The people, as we have seen, live in narrow, mutually isolated valleys, marrying within restricted genetic channels, and eating the products of local and mutually differing soils.

The result is what one might be led to expect. The samples from the 10 tribes differ more from each other than do the native-born white Americans of native parentage within the 48 states. And these differences are so great that each tribe forms a statistically separate population from all others. We are dealing with 10 different populations, phenotypically. Evidence for this can be presented briefly.³

In each measurement and index listed on table 3c, 45 possible intertribal differences may be found. Each tribe also differs from the total series, making 55 differences for each criterion. The number of significant (3 or more times p.c.) differences out of a possible 10 and 45 are as shown in table 7.

The figures show that the 10 tribes of Mountain Ghegs differ from the total series significantly in nearly four-tenths of all criteria measured, and from each other in even more. Four per cent is the proportion in this category allowed by chance alone.⁴ Differences are far greatest in the gross size dimensions of the body, not including the special measurements of the chest. Body proportions vary less than size itself. Above the neck, the 3 principal

following pages of this chapter, parts of them will be summarized. The author will keep them on file on the chance that some one may wish to refer to them in the future.

⁴Goring, 1913.

TABLE 7: NUMBER OF SIGNIFICANT DIFFERENCES.

	TOTAL	EACH OTHER
Maximum possible.....	10	45
Stature	6	30
Span	8	32
Sitting ht.....	6	28
Biacromial	7	29
Bi-iliac	4	25
Chest br.....	3	18
Chest depth.....	2	22
Rel. span.....	5	17
Rel. shoulder ht.....	2	13
Rel. shoulder br.....	4	22
Rel. sitting ht.....	3	17
Head lgth.....	7	28
Head br.....	5	25
Head ht.....	3	21
Minimum frontal.....	5	20
Bizygomatic	4	17
Bigonial	1	11
Total face ht.....	3	21
Upper face ht.....	2	11
Nose ht.....	3	21
Nose br.....	3	15
Cephalic index.....	6	30
Length ht. index.....	4	21
Breadth ht. index.....	7	26
Fronto-parietal index.....	4	21
Cephalo-facial index.....	3	19
Zygo-frontal index.....	2	7
Fronto-gonial index.....	2	6
Zygo-gonial index.....	2	5
Facial index.....	4	25
Upper facial index.....	3	25
Nasal index.....	2	13
Total	125	641
	(320)	(1760)

BY CLASSES OF CRITERIA: PERCENTAGE OF ALL POSSIBLE SIGNIFICANT DIFFERENCES

	TOTAL	EACH OTHER
5 Stand. body meas.....	62%	52%
4 Stand. body indices.....	35	38
2 Diam. of chest.....	25	44
3 Diam. of brain case.....	50	55
3 Indices of brain case.....	57	50
7 Face diam.....	30	37
3 Indices of facial br.....	20	13
3 Sagittal-br. indices of face...	30	47
2 Head-face indices.....	35	44
32 Criteria, total.....	39%	45%

diameters of the brain case and their indices are most divergent. The horizontal diameters of the face and their indices differ the least; if a decision rested on them alone it would be hard to demonstrate racial differentiation in the Gheg mountains. Sagittal diameters of the face, and the sagittal-horizontal indices, differ more.

From this we may say that in 3 respects the tribes vary metrically from the total and from one another: (1) in body diameters, greatly; (2) in brain case diameters and indices, nearly as greatly; (3) in the gross lengths of the face—particularly from nose to chin—and in indices dependent on these measurements, to a lesser extent. In one respect the tribes show a degree of relative homogeneity—in the constancy of the horizontal diameters of the face. Even here, however, they differ more than chance alone would warrant.

A similar test has been made of intertribal differences in 78 observations given on table 4; here the differences between tribes and total were not calculated—the method used was to calculate the probable errors of percentages by the tables of Ritala,⁵ and to test the significances of the differences between them.

Table 8 demonstrates that clear intertribal differences are harder to demonstrate in the observations than in the metrical characters, perhaps by virtue of the nature of the criteria themselves. Since 4 per cent of the differences over 3 p.e. can be ascribed to chance in any case, and since an equal allowance might well be made for technical inaccuracy, differences in cleanliness, in appearance at different temperatures, and light conditions, etc., I find it hard to claim valid regional differences in classes of criteria where fewer than 8 per cent of combinations are over 3 p.e. In face form, in nasal architecture, in hair development, form, and distribution, and in pigmentation, what regional differences occur seem to be of little consequence. These characters are precisely those which most anthropologists feel to be genetic. In these respects, therefore, our Gheg mountaineers are as homogeneous as their history would lead us to expect.

⁵ Ritala, 1933.

In the observations of the body and of the brain case, however, they differ more than chance and technical error would justify. In these easily influenced characters, regional phenotypes exist.

Mirdita alone. The same 3 areas stand out again in this test: the northwest, with greatest strength concentrated in Dukagin; the eastern border tribes, including Malsia e Jakovës, Has, Luma, and Dibra; and the southwest, including

TABLE 8: INTERTRIBAL COMPARISONS.

	NO. OF CRITERIA	NO. OF CATEGORIES	NO. OF COMBINATIONS	NO. OF COMBINATIONS 3 p. c.	NO. OF COMBINATIONS 3 p. c.
Body.....	12	39	1755	203	11.5%
Head.....	7	24	1080	131	12.1
Face.....	25	86	2870	206	5.3
Nose.....	11	35	1575	96	6.1
Pilosity.....	16	57	2565	177	6.9
Pigment.....	7	32	1440	107	7.4
Total.....	78	273	11,285	920	7.5%

REGIONAL VARIATIONS IN BODY SIZE AND FORM

The main difference in body size lies in the north-south cleavage between the tribes living on either side of the Drin. Those to the north are a good 6 centimeters taller than those to the south. These differences are greater to the west than to the east, so that 3 areas may be postulated; a tall northwestern, an intermediate eastern, and a short southwestern. These areas differ also in body proportions, in that the northwestern tribes (Malsia e Madhe and Dukagin) are broad-shouldered and long-armed as well, while the eastern tribes, including Malsia e Jakovës, while tall, are slenderer and narrower in the shoulders, with the southwesterners in these criteria short and slender. The acme of robusticity is reached in Dukagin, whose athletic tribesmen exceed all others to a marked degree in these special criteria. Although we lack constants for weight, which would be most valuable here, we have the evidence for dynamometer squeeze, which reveals their superiority in muscular strength (see table 9).

Dukagin men are a little stronger than those of Malsia e Madhe, but this difference is not significant. However, both Dukagin and Malsia e Madhe are significantly stronger than all of the other tribes. Among the others, Has, Luma, and Puka are all 3 stronger than Mati and Mirdita; Puka is stronger than Zadrima as well, and Malsia e Jakovës is stronger than

Mirdita, Mati, and Zadrima, with Mirdita at the lowest point. It should be observed that the 2 Catholic tribes, Dukagin and Mirdita, supposedly descended from a group of brothers, are the least alike in stature, body proportions, and muscular strength.

TABLE 9: DYNAMOMETER SQUEEZE.

	NO.	MEAN	σ
Total	1058	112.09 $\pm$.36	15.86
MeM	105	117.95 $\pm$ 1.05	15.90
Duk	106	121.20 $\pm$ 1.20	18.40
MeJ	104	108.30 $\pm$ 1.14	17.20
Has	114	110.05 $\pm$ 1.17	18.45
Lum	109	110.25 $\pm$ 1.11	17.15
Puk	102	112.80 $\pm$ 1.24	18.60
Mir	101	102.50 $\pm$ 1.39	20.65
Zad	105	105.75 $\pm$ 1.22	18.50
Mat	104	104.65 $\pm$ 1.32	19.90
Dib	108	108.25 $\pm$ 1.51	23.30

In the observations of body form, Dukagin stands out as the most athletic of all the tribes, but in general a north-south division prevails. Mentioning only the significant differences, we see that Dukagin exceeds in general musculature, while the southern tribes are least well developed. The 4 southern tribes (Zadrima, Mirdita, Mati, and Dibra) exceed in percentages of short necks, while Zadrima, Mirdita, Mati, and Has exceed in thin necks. The 3 northern tribes exceed in $\perp$ shoulder slope, the southern tribes in *sm*. To a certain extent chest development runs inversely to stature; Mirdita and Mati are the chestiest, and

Malsia e Jakovës the least so. Has stands out as moderately tall and very chesty. The vertebral borders of the scapulae, supposed to have much significance from the standpoint of general health and vigor, vary little. The lumbar curve is most pronounced in the tribes north of the Drin. None of the Gheg mountaineers had enough to eat to produce protuberant abdomens—in this criterion variation is non-existent. In general, buttocks are plumpest north of the Drin, where lumbar curve is greatest and hence pelvic tilt most pronounced; these differences between tribes in lumbar curve and buttock protrusion are more marked than any others. Calves are most developed in Dukagin and Mirdita, among the tallest and shortest tribesmen, respectively. The feet show little variability.

To sum this data up, we find tall men north of the Drin, with stature decreasing rapidly as one moves southward; to the east, the gradient of change is much less marked than in the west. In fact, 3 stature areas may be designated: the northwest, the east, and the southwest. In these 3 areas, in general, the most robust are the big men of the northwest, while the easterners tend to a lankier form. Dukagin stands out above all the others for strength and athletic development, followed closely by the *bairaks* of Malsia e Madhe. Mirdita, followed by Mati and Zadrime, lies at the other extreme. These regional differences are as great as those between Norway and France, or England and Greece.

REGIONAL VARIATIONS IN THE CRANIAL VAULT

The head length means vary nearly 7 millimeters, the breadth means 6 millimeters, and the height 4 millimeters, tribally. These differences are significant in 28 out of 45 cases for head length, 25 out of 45 for head breadth, and 21 out of 45 for head height. Heads are longest in the northwest, intermediate in the east, and shortest in the southwest. They are broadest in the northwest and more or less the same elsewhere; in height they exceed in Zadrime and Malsia e Madhe, and are lowest in Mati and Dibra, following in general a NW/SE axis.

These regional variations come out even more markedly in the cephalic index, in which

31 out of 45 tribal differences (69%) are significant, and in which the westernmost tribes are 3 to 4 index points more brachycephalic than the eastern. In the length-height index only 21 (47%) are significant, the range of means is 4 points, and only Zadrime shows any notable peculiarity. In the breadth-height index the trend is a little more marked: 26 (58%) are significant, and the range again 4 points. In general, head length varies with stature, and head breadth goes east and west, as does the cephalic index, while height indices fail to show a clear geographical pattern.

The observations on the cranial vault elucidate these tendencies in detail: Luma and Puka exceed in occipital protrusion, in which Zadrime, Malsia e Madhe, Has, Mati, and Dibra are notably wanting; Malsia e Madhe, Zadrime, and Mati are high in occipital flattening, while Dukagin, Malsia e Jakovës, Luma, and Puka are low in it. In lambdoid flattening, however, Dukagin is highest, followed by the tribes to the east. The frequencies of these 2 forms of flattening are high enough to account for much of the difference in head form shown by the measurements and indices. How much, will be explored later.

REGIONAL VARIATIONS IN THE FORM OF THE FACE

Malsia e Madhe has significantly broader foreheads than all of the other tribes, which vary little, growing slightly narrower to the east and south. Nine out of 20 of the significant differences between the tribes in this measurement are caused by the peculiarity of Malsia e Madhe. In the bizygomatic, Malsia e Madhe and Dukagin, both broad, account for 12 out of 17 of the significant differences; Dibra, the narrowest, is significantly different from all but 3. The bigonial is the most constant of all measurements, and Dukagin, the widest jawed, accounts for 6 out of 11 significant differences. Only one difference, Dukagin: Dibra, goes over 4 times p.e. One may summarize these differences in face breadth by saying that in general the broadest faces are in the northwest and the narrowest in the southeast; that the greatest differences are in the upper part of the face and the least in the lower.

In the heights of the face, one tribe stands apart from the others: Has. It has the longest total and upper face heights, by far, of all. In the total face height it accounts for 8 out of 22 significant differences; in the upper face height, 9 out of 11. If we ignore Has, the others are much the same, with the shortest faces, in both dimensions, in the southwestern tribes. Here, then, the dichotomy is, Has versus all others.

The fronto-parietal index, showing the relationship between head breadth and forehead breadth, varies only 2 index points, and as might be expected the broadest-headed tribes have the lowest values, and the narrowest-headed the highest. No single tribe or group of tribes distinguishes itself in this character. The cephalo-facial index, relating head breadth to face breadth, runs much the same way, with equally little variation. The zygo-frontal index scarcely varies at all, and all 6 of its significant differences are due to the fact that Mirdita falls one index point below most of the others, on account of its face breadth, which is a little broader for its size than the others. The fronto-gonial and zygo-gonial indices are even more constant. Four out of 6 significant differences in the former are due to the broad foreheads of Malsia e Madhe, and all 4 in the latter to Mirdita's combination of a medium face breadth and the narrowest mandible of all. *We may consider the Mountain Gheg phenotype a unit in these horizontal proportions of the head and face*, with very slight deviations in the cases of Malsia e Madhe and Mirdita.

The observations of these characters help even more. In the height and slope of the forehead, almost no differences of statistical validity occur, while in the observed breadth of the forehead Luma, Puka, and Malsia e Jakovës come out low in the percentage of double and triple plus breadths. No differences of moment are seen in the size of the browridges or in glabella; the forward jut of the malars, the fullness or wrinkling of the cheeks. In the sidewise thrust of the malars and in the prominence of the gonial angles, not one single significant difference can be found in the percentile values of any category. In the morphological observations which relate to the gross architecture of the face, exclusive of the eyes, nose, and mouth, the tribes are as one.

If we move down to the chin, however, one tribe differs from all others: Dukagin has fewer *sm* values for chin prominence than any other tribe, and all these are significant; it also has more bilateral chins than all others, and its excess is significant in each case. The chin of Dukagin stands as a notable exception to the otherwise uniform position of the Mountain Ghegs in face structure. That prominent, bilateral chins should be associated with an excess of size and strength is not surprising.

The noses of the Ghegs vary about 3 millimeters in height, and $1\frac{1}{2}$ millimeters in breadth; Has, as might be expected, has the longest noses, but it also has the broadest. Nine out of 21 significant differences in nose height are due to Has, and 6 out of 17 in breadth. The nasal index varies about 4 points, with the lowest values in the east and the highest in the west, but all approximate the lowest human extreme. Out of 13 significant differences, 6 are due to the fact that Dukagin is highest.

The observations of the nose, which carry our study into minute detail, confirm the remarkable regional constancy of form of this organ. In nasion depression there are no significant differences at all; and there are none in that most critical character, the form of the nasal profile. In root height and bridge height, Dibra shows a slight excess over a few others; Dibra is also a little narrower in the bridge breadths, accounting for 8 out of 10 significant differences in this character. Malsia e Madhe accounts for 7 out of 8 such differences in tip thickness, for it is slightly thicker than the others; the eastern tribes are a little thinner. Twelve out of 22 differences in tip position reflect the greater sag in the Has nose, a difference for which we shall presently account. In the form of the nasal wings, another highly significant character, not one tribe has more flaring forms, in a statistical sense, than any other; the few differences between the compressed and medium categories show an excess of the compressed form in Has and Dibra. The shape of the septum is constant, except for Zadrina, which is significantly straight compared to all of the eastern tribes; in the inclination of the septum, the western tribes, Malsia e Madhe, Zadrina, and Mirdita, show a significant tendency to turn down in comparison with those to the east.

A few features of the soft parts of the eyes show significant tribal variation. The western tribes, particularly Zadrina, Malsia e Madhe, and Dukagin, have large minorities with external eyefolds, rare in the east and in Mati. Men from Dukagin tend to narrow their eyelids to slits, and this accounts for 14 out of 28 significant differences in palpebral opening. The same tendency in Has accounts for 9 of the rest. In the case of Dukagin, at least, part of this may be due to the fact that I measured them in the snow, in bright sunlight. Most of the tribes had 20 to 30 per cent of slight eye obliquity, but Has with only 8 per cent was significantly below the others. This obliquity was not up, Mongol-wise, but down, as is usual in narrow-faced Europeans.

The lips show a few local differences only: Dukagin has thicker integumental lips than the others, in 18 out of 23 significant cases; Has runs low and Malsia e Madhe high in membranous thickness, to a very minor degree in each case; Malsia e Madhe and Malsia e Jakovës have a little more lip eversion than the others. Only a few of these differences reach 3 times p.e., and only one attains 4. Except for Dukagin's thick upper lip, we can ignore the rest.

Turning to the ears, we find no differences of consequence. We have 6 observations, in all of which only 20 differences of 3 times p.e. or over are found, out of a total of 810 computed. Of these only 4 are over 4 p.e., and one reaches 5 p.e. We may say with confidence that the Gheg tribes are alike in the frequency of the component factors in ear form.

REGIONAL VARIATIONS IN PILOSITY

In the observed form of the hair, the ratio of deep to low waves is virtually the same between all tribes, except for Has, which is recorded to have significantly more deep-waved individuals than all other tribes, except for Malsia e Madhe and Dukagin. Aside from Has the others are virtually the same. Owing to the prevalence of head shaving in some tribes, and the fact that my Has sample all lived near the city of Prizren, where modern haircuts are more in vogue than elsewhere, I have no confidence in this distinction. In hair texture, Zadrina shows a tendency in favor of fineness, and Luma of being medium, and both have some statistical validity. Again, I

do not trust my power of observation enough to confirm these. In baldness, it is Has against the others, a distinction which can be explained on another basis. In the quantity of head hair (apart from bald areas) Dibra shows an excess over most others. Mustache hair quantity, eyebrow thickness, and eyebrow concurrency, show no regional variations, and these are prime racial criteria.

The lateral extension of the eyebrows, however, does vary. Here the split is essentially but not typically nw/se again; the wide-browed tribal sample being particularly those of Dukagin, Malsia e Jakovës, Puka, and Zadrina, the narrow-browed those of Has, Luma, Mirdita, Mati, and Dibra. In this single criterion 41 significant differences occur. In 10 characters dealing with hair quantity, 124 significant differences exist; one-third of these are therefore found in the single character of lateral extension of the eyebrows. Aside from the variations in cranial vault and for Dukagin's chin, this is the biggest difference in observations to appear so far. In the development of the various segments of the facial hair, aside from the eyebrows, no notable differences are found, and in body hair there is a tendency for Dukagin and Malsia e Madhe to fall low on absents, and for the eastern tribes to be high on the hairiest categories. These tendencies are of a minor nature.

REGIONAL VARIATIONS IN PIGMENTATION

In skin color, only Has shows any consistent difference from the others; the skins of these men were recorded as medium-white rather than light in about 20 per cent of cases; this minority of one-fifth of other-than-fair skins is not only significant statistically, but also probably accurate technically. The Has men were also the more frequently vascular.

In the head hair color, the only differences of importance lie between the black and dark brown categories; all tribes are equally endowed with reds and blonds. Has is outstanding for its predominance of black, and Dukagin of dark brown. This may possibly be explained by age and by haircuts, but it may also be valid. Between them these 2 account for every single statistically significant difference in this character; in all, 20. In mustache color a few differences appear, as for example,

Malsia e Madhe, Dukagin, and Malsia e Jakovës tend to be a little stronger in dark browns, Zadrina and Dibra in red browns, and Has and Puka in blond shades, than the others. Of a paltry 14 differences, all but 2 are below 4 times p.e., and can be discounted.

In eye color, a few tendencies appear; Dukagin and Malsia e Jakovës with 23 per cent dark brown, exceed about half the others significantly; Dibra has a concentration of light brown eyes, exceeding all but 2 of the others significantly. Mati and Zadrina have a tendency to exceed in zoned iris forms. These pigment differences may denote very minor genetic variations, but are really of little consequence.

REGIONAL DIFFERENCES BETWEEN TRIBES SUMMARIZED

Having been through all of the differences between tribes in all characters measured and observed, and having tested all for statistical significance, we can now list the particular differences which indicate regional variations in the Mountain Gheg phenotype (fig. 12, *a*).

1. The men north of the Drin are taller, more muscular and stronger than those south of it. They also have broader shoulders, longer arms, longer and thicker necks, more sloping shoulders, greater lumbar curves, and more protuberant buttocks. The 2 extremes in these characters are Dukagin and Mirdita. The tribes to the east, from Malsia e Jakovës to Dibra, show little variation in these features; the main drop between north and south falls to the west. These differences are as great as one might expect in a continent, and unusual in so small a territory.

2. Where bodies are largest, heads are largest too. Aside from this heads are shortest, broadest, and highest in the northwest, and the opposite in the east. Occipital flattening reaches its maximum in Malsia e Madhe and Zadrina, while lambdoid flattening and its companion, bathrocephaly, are highest in Dukagin. Tribal differences in head form are as great as those in body size and strength.

3. Faces are remarkably homogeneous in Malsia e Ghegnisë. Tribal variations are at a minimum. A few local peculiarities occur: broad foreheads in Malsia e Madhe; excessive face heights without eye obliquity in Has; Dukagin has a statistically noteworthy excess of bilateral chins, unusually few of which are receding; Zadrina has a tendency toward a straight, downturned nasal septum, and Dukagin to a thick integument in the region of the lips.

4. Has runs bald. The northwestern tribes have

more widely extended eyebrows than those in the southeast.

5. Has shows a minor tendency to medium skin color, and to black head hair; Dukagin tends to dark brown hair. The northern tribes have an excess of dark brown, and Dibra of light brown, eyes.

While the differences in body size and head shape are great, the similarity in face form, pilosity, and pigmentation is also great, and Ghegs look alike. The tribes that diverge from the total picture the most are those around the edges; the big broad-heads of Malsia e Madhe, the muscular cleft-chinned giants of Dukagin, the medium-sized broad-heads of Zadrina, and the minority of light brown-eyed Dibrans, who with their tribal brethren have somewhat narrower faces and noses.

One of the most revealing results of this intertribal comparison is the discovery that the tribes vary most among themselves not in the conventional criteria of race, but in what are usually considered to be minor or inconsequential anatomical features. If we revert for a moment to the statistics of validation, we find that values of 7 times p.e., or over, are most noticeable in the biacromial diameter, in which Dukagin exceeds all comers; span, stature, and sitting height follow in importance. In the biacromial, Dukagin exceeds all but its 2 neighboring tribes, Malsia e Madhe and Malsia e Jakovës, by 10 or more times p.e. Thirty-seven out of 69 intertribal differences in 7 body observations which reached 4 or more times p.e. were concerned with buttocks and lumbar curve; 4 out of 5 that exceeded 6 p.e. were the same. Again Dukagin is the odd tribe.

In the measurements and indices of the head, 42 differences of 7 or more times p.e. are found, reaching an extreme of 14 p.e. in the comparison between the cephalic index of Malsia e Madhe and Luma. Malsia e Madhe exceeds all other tribes in head breadth by 7 to 11 times p.e.; that is the outstanding result of this inquiry. In the observations of the head, bathrocephaly leads all in tribal differentiation, followed by lambdoid flattening. These 2 features are concentrated in Dukagin, but neither go over 6 p.e. Zadrina is noteworthy not so much for its occipital flattening, in which it shares honors with Malsia e Madhe, as for its lack of lambdoid flattening and bathrocephaly.

In the face, only 2 features attain high ratios of significance: the wide-extending eyebrows of Dukagin, as compared to Has, which attain 9 times p.e.; and in a lesser degree to Dibra and Mati; and the bilateral chins of Dukagin, which approach 9 p.e. in comparison with Puka, its neighbor over the Drin, and 7 with Malsia e Madhe, Mirdita, Zadrina, and Mati.

What are the important intertribal variants, then, in Malsia e Ghegnisë? Not stature, not hairiness, not the shape of the head (although its breadth is important); not the form of the face—but the breadth of the shoulders, the failure of the occipital bone to join the pari-

etals smoothly at lambda, the flare of the eyebrows, and the habit of the mandible to form a lump on either side of the chin, instead of a bar in the middle. When we are dealing with relatively homogeneous populations, such as that of a small, isolated segment of a European country, it is in factors like those just mentioned that one obtains the most valid regional differences. It is by the appearance of such differences and their spread in isolation that races are formed. In Malsia e Ghegnisë, the most peculiar tribe by far is Dukagin, which is also the most isolated.

AGE

THE dimension of time can never be neglected in studying the properties of bodies, including those of human beings. Time is the scale on which we grow to maturity and shrink into old age. In this particular study time sets us 3 problems: (1) what is the range of the series in terms of age groups, and how do the component tribal subseries vary in this respect; (2) in what way does its age distribution affect the comparability of this with other series; and (3) to what extent, if at all, do differences in age account for the intertribal differences in growth, form, pigment, and pilosity, discovered in the last chapter?

ACCURACY OF THE PRESENT DATA

Probably not more than a dozen of the younger men whom I measured knew exactly how old they were. None of the older men did. The Ghég mountaineers work and play by families, and not by age grades. Nothing in their way of living makes a precise knowledge of age useful. Sometimes when I was measuring a group of 20 or 30 men, all from

the same place, certain members of the elder generation might know who was the oldest, and the birth order of the others on down, but they would not know how old any one man might be. Sometimes they could date a birth roughly by some local historic event, and this would give a serviceable anchor. More often I had to use my own judgment on the basis of tooth eruption, loss, and wear; wrinkling, graying, and the like. When asked their ages the men would usually reply in round numbers, "About 50," "Perhaps 40," etc., and most senile individuals declared themselves to be 100.

Possessing no illusions as to my ability to judge age in mature, outdoor-living white males, I believe that the degree of accuracy of the age judgments so made must vary considerably. We are faced with a probable error, not only of sampling, but also of the accuracy of the material itself. The latter renders the use of refined statistical constants specious. Table 10 takes only the first source of error into consideration.

TABLE 10: AGE.

TRIBE	No.	RANGE	MEAN P.E.	σ	P.E.	V	P.E.
Total series.....	1063	18-65+	39.40 $\pm$.26	12.50 $\pm$.18		31.73 $\pm$.66	
Malsia e Madhe.....	105	20-65+	38.05 $\pm$.71	10.80 $\pm$.71		28.38 $\pm$ 1.32	
Dukagin	106	25-65+	37.80 $\pm$.61	9.25 $\pm$.43		24.47 $\pm$ 1.13	
Malsia e Jakovës.....	104	18-65+	35.85 $\pm$.75	11.50 $\pm$.54		32.08 $\pm$ 1.50	
Has	113	18-65+	44.30 $\pm$.82	12.95 $\pm$.58		29.23 $\pm$ 1.31	
Luma	108	18-65+	36.70 $\pm$.87	13.50 $\pm$.62		36.78 $\pm$ 1.69	
Puka	101	18-65+	36.10 $\pm$.92	13.70 $\pm$.65		37.95 $\pm$ 1.80	
Mirdita	101	21-65+	43.60 $\pm$.85	12.60 $\pm$.60		28.90 $\pm$ 1.37	
Zadrima	105	21-65+	43.70 $\pm$.78	11.80 $\pm$.55		27.00 $\pm$ 1.26	
Mati	103	18-65+	35.80 $\pm$.67	10.10 $\pm$.47		28.21 $\pm$ 1.33	
Dibra	108	18-65+	42.00 $\pm$.88	13.55 $\pm$.50		32.26 $\pm$ 1.48	

PERCENTILE DISTRIBUTION

	No.	PER CENT
18-20	12	1.1
21-24	99	9.3
25-29	155	14.6
30-34	166	15.6
35-39	162	15.3
40-44	129	12.1
45-49	103	9.7
50-54	88	8.3
55-59	52	4.9
60-64	56	5.3
65+	41	3.8
	1063	100.0

AGE IN THE SAMPLE AS A WHOLE

From it we may see that the sample is a mature one, and that it includes a wide spread, from 18 to 65 years and over, with each age grade over 19 represented by a statistically adequate subsample. We must expect our criteria to show every condition from late adolescence to senility. However, being unable to obtain exact age figures even at the lowest age level, I threw out all obviously immature boys no matter how old they claimed to be, and hence the 18-20 group may have been selected. At the other end, I tried not to take bent-over, toothless old men, deformed by the diseases of senile decay. Hence my oldest age grade may also be selected, since senility does not strike all men equally at the same age.

The sample, insofar as it is accurate, gives an age spread suitable for racial study, since it includes the whole span of ages in which racial criteria find their full expression. It can also be used in a limited sense to study age changes. It is, however, no substitute for a study of changes, year by year, in the same individuals. Such a study is hard to make, for the observer himself lives on the same time scale as his subjects. Age changes studied in terms of different individuals have a much more limited application. If the sample is genetically constant in the generations covered (and, as far as we can tell, this one is), then the differences between age groups indicate changes that have been going on among the people concerned. By this means one can hope to track down progressive changes due to changing environmental influences acting on the organism either directly or through the agency of genetic selection.

TRIBAL VARIATIONS IN AGE

Table 10 also shows us that mean age varies regionally. The difference between the age of the youngest sample, Mati, and that of Has, the oldest, is 8.50 years, or 8.45 times p.e. This difference is probably great enough to be valid, even when my judgment in assigning ages to the subjects is taken into consideration.

From the sampling point of view only, most of the tribes differ significantly from each other in age means, although the age range of each is virtually the same. Six out of 10 vary

from the total mean more than 3 times the probable error. In the following statistical exercises, whenever we compare tribal samples with each other, we must remember that there is an 8-year probable span of age means, from 36 to 44 years, and that we must not consider regionally significant a difference in any criterion which varies less regionally than it varies in this 8-year age span in the series as a whole.

This question is further complicated by the fact that some tribal samples are more dispersed in age distribution than others. This can be measured by the values for the standard deviation. Dukagin has a σ of 9.25 years; Puka of 13.70 years. These are the extremes. This difference of 4.45 years = $5.71 \times$ p.e. and this is thus statistically significant. This difference in variability may also be expected to qualify the means in certain cases. In a character in which the highest values are found at, let us say, the 35-39-year-old age locus, and we have 2 samples each with a mean age of 38, then the sample with the lowest value for σ may be expected to show the higher mean. This is another reason why we must allow a little more than the conventional amount of leeway in interpreting the statistical significance of differences between tribal and other samples.

AGE AND STRENGTH

No single criterion can be found which expresses the changing health, maturity, and vigor of a man more than his muscular strength. Table 11 shows values for hand squeeze in

TABLE 11: AGE AND STRENGTH, IN POUNDS.

AGE	#	RANGE	MEAN P.E.	σ	V
20-24...	107	60-160	112.80 $\pm$ 1.11	17.10	15.20
25-29...	154	75-170	115.00 $\pm$.93	17.10	14.86
30-34...	164	50-180	114.60 $\pm$ 1.00	19.00	16.61
35-39...	163	70-185	115.30 $\pm$ 1.07	20.15	17.42
40-44...	125	45-170	112.10 $\pm$ 1.16	19.25	17.16
45-49...	106	50-150	103.65 $\pm$ 1.36	20.85	20.15
50-54...	88	65-140	103.90 $\pm$ 1.17	16.25	15.64
55-59...	51	50-140	103.35 $\pm$ 1.65	17.45	16.83
60-64...	58	50-130	96.05 $\pm$ 1.46	16.55	17.20
65-69...	15	50-115	91.00 $\pm$ 2.65	15.20	16.82
70-74...	14	70-130	95.70 $\pm$ 3.02	16.70	17.46
75-89...	11	75-110	90.00 $\pm$ 2.34	11.50	12.78
65-89...	40	50-130	92.40 $\pm$ 1.62	15.05	16.30

pounds for all age grades from 20-24 to 75-89 years; and also for 65-89 years pooled. Out of 78 possible comparisons, when we ignore the pooling, 44 reach 3 or more times p.e., and when we count 65 onward as pooled, the score is 31 out of 55. Eleven of these differences exceed 9.00 times p.e. Our mountaineers reach their peak of squeeze-power in their late 30's, decline slowly for half a decade, and then weaken more rapidly after 45. The combination of physiological changes which this curve reflects may be traced in the metrical and morphological characters which follow.

AGE AND SELECTED METRICAL CHARACTERS

Table 12 presents the means for 7 selected metrical characters. Having neither time nor space to compute and present age grade means in all criteria, I selected some which have a special bearing on the problems of this study as well as general interest. The 12 youths probably born after 1910 are not numerous enough for full statistical treatment. Although they deviate from the trends shown by the

other age groups, this cannot be interpreted with any assurance. This is unfortunate, since many of the largest series in the European literature represent this age grade alone—measured on recruits.

Stature in our series changes very little with age (fig. 4). Only 6 out of 55 differences between age grades reach 3.00 times p.e.; only one reaches 4.00 times p.e. This is barely significant. Judging by the trend of means alone, our mountaineers reach their peak of height at the same time that they are strongest, in their late 30's. The rises at both ends of the scale may represent selection, as discussed earlier. In any case there is no evidence that the mountain population was growing taller during the last third of the 19th and first fifth of the 20th centuries. From 1865 to 1929 most of the peoples of western Europe, and the Americans, were experiencing a steady growth increase. Whatever factors caused this in the west did not reach the mountains of northern Albania. This conclusion may be confirmed by a study of 17 pairs of brothers. The older was taller than the younger in 9 instances, the

TABLE 12: AGE GRADE MEANS FOR SELECTED METRICAL CHARACTERS.

BIRTH E YEAR	No.	STATURE	HEAD LENGTH	HEAD BREADTH	HEAD HEIGHT	BIZY- GOMATIC	CEPHALIC INDEX
19....1911 ca.	12	173.25	182.75	154.99	128.50	137.00	85.25
24....1908	99	169.73 ± .44	186.27 ± .50	156.24 ± .39	130.02 ± .42	140.60 ± .35	83.90 ± .32
29....1903	155	169.24 ± .34	185.63 ± .37	157.00 ± .35	128.57 ± .31	141.67 ± .28	84.71 ± .24
34....1898	166	169.79 ± .39	186.54 ± .36	157.86 ± .24	127.77 ± .24	142.33 ± .30	84.66 ± .20
39....1893	162	170.46 ± .35	186.22 ± .37	158.22 ± .29	128.19 ± .27	142.65 ± .27	85.02 ± .21
44....1888	129	170.14 ± .44	185.46 ± .47	159.03 ± .40	128.73 ± .36	142.85 ± .30	86.14 ± .28
49....1883	103	170.13 ± .48	186.90 ± .41	158.75 ± .40	128.74 ± .43	143.20 ± .37	84.87 ± .26
54....1878	88	169.01 ± .41	186.99 ± .53	157.99 ± .43	127.26 ± .27	143.09 ± .43	84.41 ± .31
59....1873	52	169.41 ± .55	185.54 ± .59	157.45 ± .61	126.64 ± .62	143.85 ± .52	85.04 ± .42
64....1868	56	167.34 ± .57	185.20 ± .51	157.38 ± .49	127.77 ± .48	142.70 ± .45	85.23 ± .33
1....1865	41	170.18 ± .62	187.61 ± .73	157.22 ± .56	128.78 ± .66	143.10 ± .36	83.28 ± .44

BIRTH AGE YEAR	No.	TOTAL FACE HEIGHT
18-19....1911 ca.	12	122.40
20-24....1908	98	121.90 ± .49
25-29....1903	153	121.87 ± .34
30-34....1898	163	123.93 ± .25
35-39....1893	151	124.05 ± .36
40-44....1888	111	123.99 ± .44
45-49....1883	85	124.45 ± .48
50-54....1878	61	124.85 ± .49
55-59....1873	30	125.16 ± .72
60-64....1868	37	125.92 ± .68
65 + ...1865	16	126.69 ± 1.35

younger taller than the older in 8. The mean stature of the older was 171.72 centimeters, of the younger 171.47 centimeters; the mean age of the older, 41 years, of the younger, 33 years. In America and elsewhere where growth increases are in process, the younger brothers are taller than the older ones.¹ This study of

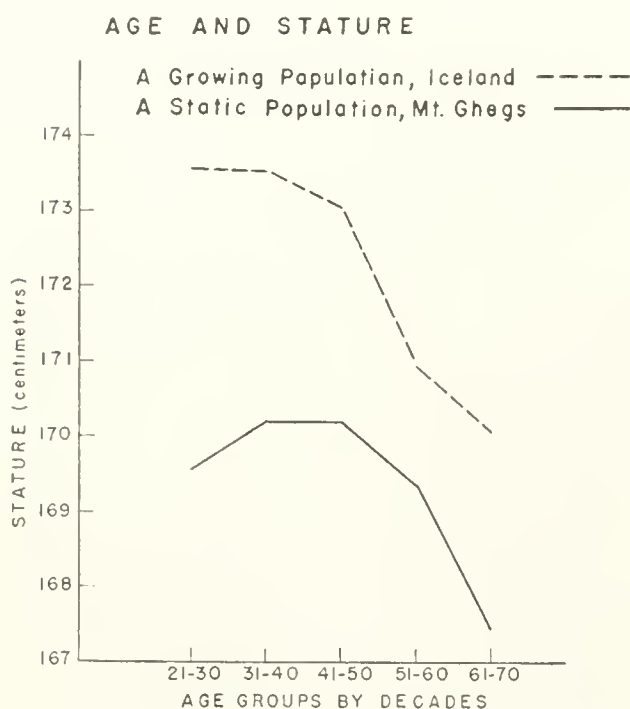


FIG. 4. Age and stature.²

stature means several things: differences between age groups are so slight that our intertribal stature comparisons need no age correction; we can compare our Ghegs with younger series, since the men over 50 will balance those in their 30's and 40's; since size changes comparable to those seen in certain other countries are not going on in the principal sagittal dimension of the organism, the same is probably true of the organism as a whole.

The head length shows even less variation with age than stature; in fact not a single difference between the means of the 11 age grades from 20 years old onward is statistically significant. Furthermore, no clear if minor trends are shown in the succession of means, except possibly for the dip between 55 and 64 years.

¹ Bowles, 1932.

In head breadth, on the contrary, the means increase consistently and regularly to the 40-44-year age group, and then decline with the same regularity. This sequence in itself has meaning, enhanced by the fact that 6 of the differences between age group means are statistically significant. The cephalic index mirrors head breadth, with the same succession, and with 9 differences of 3.00 or more times p.e., of which 3 exceed 4.00 and one exceeds 5.00. This combination is unusual. One expects the head length to grow with age and then gradually decline as the soft parts thin out; here the burden of age change is borne by the breadth. The change of 2 index points in the cephalic index which accompanies this phenomenon cannot be responsible for the intertribal differences in that character, since the tribes which one would expect to be the most brachycephalic on a basis of age variation are the least, and vice versa.

In the head height, 6 differences are statistically significant, out of the usual 55. Two of these are over 4.00, one over 5.00. The table shows, however, no trend; higher and lower vaults alternate at random. If any factor other than chance is at play here, present evidence is not adequate to unearth it.

The face behaves differently with age (fig. 13) from the brain case. This is to be expected from what we already know of growth in man elsewhere. The bizygomatic diameter keeps on increasing to the late 40's, when it levels off; 11 out of 55 differences are significant; 6 are over 4.00, and 2 over 5.00 times p.e. The total face height grows continuously throughout life; the means never level off. Sixteen differences are significant, with 8 over 4.00, and one over 5.00 times p.e. This means that our Mountain Ghegs may owe part of their greater face length, and breadth, over other European series to their more advanced age. Without question this applies in even greater measure to the nose diameters and nasal index, which were not seriated here since they do not vary intertribally. The face dimensions do vary intertribally, and thus require further consideration.

² Icelandic material from Hannesson, 1925.

AGE AND CERTAIN SOFT PARTS OF THE FACE

A number of regressions have been made between age and some of the soft parts of the face, not all of which need be given in detail. On table 13, only those characters in which age changes play a part of interest to us here

have been plotted. Three different techniques of comparison are used, of which one, being new, is explained. The integument of the lips grows steadily although not greatly thicker with age until the 50's, after which its behavior is variable, which may be explained on the basis of tooth loss; when teeth are gone it is harder to observe this character than when they

TABLE 13: MEAN AGES, IN YEARS.

	ABS.		SSM		SM		+		++, +++	
	No.	MEAN	No.	MEAN	No.	MEAN	No.	MEAN	No.	MEAN
Lips, integ. thick.....					22	(46.18)	908	38.69	133	43.54
Lips, membr. thick.....	91	51.29	19	(48.84)	455	42.00	467	35.52	31	36.04
Nasal tip thick.....			31	38.13	371	38.50	544	39.61	117	42.05
Ear lobe, develop.....					434	36.66	568	40.14	61	49.10

Nasal Wings:	No.	MEAN	Nasal Profile:	No.	MEAN
Compressed	383	38.75	Concave	69	36.67 ± .96
Medium	621	39.98	Straight	414	37.83 ± .35
Flaring	61	37.82	Convex	569	40.89 ± .36
			Concavo-convex ...	11	(38.82)

	No.	MEAN
Nasal Tip, Elevation-Depression		
Elevation ++	36	36.45
" + ...	332	37.68
" sm	230	38.39
Depression sm	173	40.32
" + ...	256	40.46
" ++	36	42.97

MEAN VALUES OF FOUR OBSERVATIONS*

					Nasal Profile, by Percentages							
			NASAL	EAR							CONCAVO-	
	LIPS,	LIPS,	TIP	LOBE	CONCAVE		STRAIGHT		CONVEX		CONVEX	
AGE	INTEG.	MEMBR.	THICK.	DEV.	#	%	#	%	#	%	#	%
18-20.....	50.0	43.8	33.3	35.4	2	16.7	6	50.0	4	33.3		
21-24.....	50.2	42.2	44.1	37.4	9	9.1	51	51.5	38	38.4	1	9.1
25-29.....	51.4	40.7	41.1	37.9	13	8.4	59	38.1	81	52.3	2	18.2
30-34.....	52.3	40.1	40.5	37.4	9	5.4	68	41.0	86	51.8	3	27.3
35-39.....	51.8	36.0	41.8	40.1	10	6.2	66	40.7	85	52.5	1	9.1
40-44.....	54.8	33.0	44.0	42.6	6	4.6	50	38.8	72	55.8	1	9.1
45-49.....	54.4	32.1	46.2	43.2	9	8.7	36	35.0	57	55.3	1	9.1
50-54.....	55.1	31.2	44.9	43.5	5	5.7	39	44.3	44	50.0		
55-59.....	51.0	26.4	45.7	45.9	3	5.8	13	25.0	36	69.2		
60-64.....	54.5	24.3	44.5	50.0	3	5.4	15	26.8	37	66.1	1	9.1
65 + ...	50.6	18.0	42.4	49.7			11	26.8	29	70.7	1	9.1

* This table represents an attempt to render subjective observations mutually comparable. The means listed above have been computed as follows: Absent=0. ssm=12.5. sm=25. + =50. ++ =75. +++ =87.5. Multiply the absents x 0, the ssm's x 12.5, the sm's x 50, etc., and divide the sum by N. Result is the mean as given above. This method, although mathematically dubious, is nevertheless a convenience, for it is easier to compare single figures than galaxies of percentages; and in this way progressive trends may be discovered.

are present. Conversely, the lip membrane, as far as could be observed, thins with age. The relationships between this feature and various dental characters, such as occlusion, will be discussed in the next chapter. For the present it is enough to state that part at least of the George Washington look of the Mountain Ghég lips is due to age. The ear lobe also grows steadily, slowly until the early 50's, then faster.

The nasal wings change little; the tip, however, thickens gradually to the late 40's, and then thins out slightly; these changes are very slight and significant only in their directional constancy. The position of the tip, however, changes steadily and significantly with age; the high frequency of depressed tips in our series is partly a reflection of it.

Aside from the shape of the back of the head, the most distinctive character of Dinarics is the nasal profile, the high frequency of hawk beaks being distinctive. In our percentile series a frequency of 50 per cent or over for convex

profiles is reached only by the late 20's; it remains fairly constant until the late 50's, and then increases notably, probably as the soft parts of the nose thin out and the tip pulls downward. The age mean differences between concave and convex and straight and convex are significant; so are the percentile differences between the 20-24-year-old group and the 3 oldest categories. If one were to measure a series of 20-year-old Ghegs, one would probably find straight noses in the majority, with concave appearing perhaps as often as convex. The convex nose, so distinctively Dinaric, is in part a feature of age. So is the long face, so are the thin lips. The "typical" Dinaric is a man past middle age.

AGE AND PILOSITY

Table 14 and figure 5 show the changes in pilosity that occur in our series with advancing age. Some 13 per cent are bald to some degree. As table 14 shows, this rises steadily with age. None of the youngest age group was

TABLE 14: AGE AND HAIR QUANTITY.

Means of Criteria*										
AGE	No.	BALD- NESS	HEAD	No.	MUS- TACHE	CHEEKS	JAW	ARMS & LEGS	CHEST	
18-20.....	12	0	54.17	12	41.67	18.75	22.50	27.50	8.33	
21-24.....	99	1.77	50.51	99	39.90	28.66	30.93	34.47	17.05	
25-29.....	153	3.03	49.68	155	42.55	37.66	40.41	40.73	27.10	
30-34.....	162	4.27	50.62	166	48.27	45.63	47.97	44.58	34.86	
35-39.....	159	5.82	48.59	162	56.32	50.39	53.24	47.53	36.65	
40-44.....	129	9.42	48.05	129	57.75	53.49	54.55	49.71	41.96	
45-49.....	99	12.55	47.19	103	58.50	52.31	55.34	49.51	43.08	
50-54.....	83	13.56	46.48	88	57.95	52.41	56.25	51.99	45.00	
55-59.....	51	17.15	41.67	52	58.65	55.39	56.73	48.56	40.62	
60-64.....	56	17.62	40.85	56	58.48	55.80	57.14	49.55	48.21	
65 + ...	41	18.62	42.07	41	60.06	57.32	58.23	46.34	61.89	

Age Means										
	ABS.		SSM		SM		+		++	
	No.	MEAN	No.	MEAN	No.	MEAN	No.	MEAN	No.	MEAN
Baldness	803	36.79	22	47.68	128	48.21	71	49.03	19	50.18
Head Hair										
Quant.....					143	48.70	842	37.88	58	37.43
Mustache ...			16	23.87	81	26.57	727	39.10	239	45.59
Cheek	50	28.10	52	32.38	189	39.12	540	39.95	232	45.71
Jaw	21	24.68	28	27.00	183	32.87	593	40.05	238	45.80
Arms and										
Legs			16	32.00	280	34.27	636	40.53	131	45.93
Chest	249	32.74	14	41.29	243	38.44	377	41.48	169	46.20

*See footnote to table 13.

(Note: Chest +++: 11 49.27)

bald; 22 per cent of the oldest were. The thickness of the head hair, where any remained, became gradually reduced from the early 30's onward, but this change was a minor one.

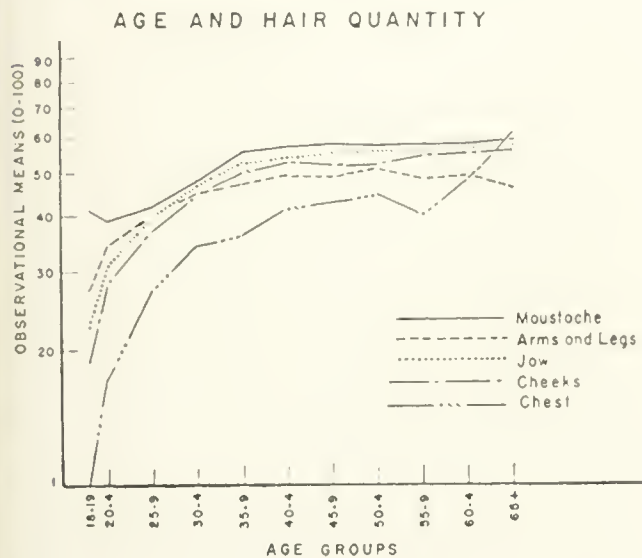


FIG. 5. Age and hair.

Of the face hair, the mustache grew out first, as expected, and changed relatively little; here age is a minor factor. The hairiness of the cheeks and jaw increased to the ratio of 3 to 1 and 2 to 1. Of the body hair, that of

the arms and legs increases in the same fashion as cheeks and jaws until the mid-30's, and then remains constant. The chest hair increases most of all kinds of hair observed.

With such a population, and this applies for most if not all "white" peoples, it is useless to compare 20-year-olds, such as are commonly recorded in army statistics, with a mature sample like this. But samples with mean ages between 35 and 60 years old would be comparable. This means that our tribal samples, despite their significant age variations, can still be compared with each other in the 7 criteria of hairiness used in this study.

AGE AND GRAYING

Table 15 and figure 6 show other age changes in the hair—the progressive loss of pigment with age, known as graying. The head hair begins to gray at an earlier age than that of the mustache, which overtakes head hair in the late 50's. Whereas hair quantity reaches its adult stage in the 30's and then levels off, graying progresses in a different fashion. From the early 30's until the late 40's it follows one rate of progression which shows as a parabola on a straight graph and a straight

TABLE 15: AGE AND GRAYING.

Degree of Grayness by Age Groups					Per cent Remaining Totally Ungrayed	
HEAD		MUSTACHE			HEAD	MUSTACHE
AGE	No.	MEAN*	No.	MEAN		
18-20.....	12	0	12	0	100.00	100.00
21-24.....	99	.25	99	0	98.99	100.00
25-29.....	155	3.67	155	.48	89.03	98.71
30-34.....	166	2.95	166	.30	90.36	99.40
35-39.....	161	7.38	161	2.17	75.78	91.93
40-44.....	130	16.44	129	9.50	59.23	72.87
45-49.....	103	29.00	103	22.32	36.89	43.69
50-54.....	88	35.23	88	31.68	25.00	37.50
55-59.....	52	41.82	52	37.02	21.15	28.85
60-64.....	56	55.12	65	57.14	8.93	3.57
65+.....	41	69.82	41	73.50	2.44	0

Mean Ages of Degrees of Graying

HEAD MUSTACHE

	#	AGE	#	AGE
Abs	674	33.49	766	33.98
ssm	26	42.67	4	(47.00)
sm	119	44.22	83	46.52
+	140	47.89	127	53.38
++ ..	77	56.02	64	59.30
+++	17	60.82	11	(65.18)
White .	9	63.67	7	(64.86)

Degree of Grayness

ALL AGES

	#	MEAN*	#	MEAN	AGE
Black	420	24.84	420	43.39	.40
Dark brown.....	473	8.53	473	35.45	.29
Reddish-brown ...	16	13.42	16	(40.12)	
Light brown.....	89	4.64	89	35.42	
Blond	24	6.25	24	(37.42)	

*By method explained in footnote to table 13.

TABLE 15 (continued)

Hair Color and Age Grades

AGE	TOTAL	BLACK		DR. BR.		RED BR.		LT. BR.		BLOND		LT. BR. & BLOND		UNKNOWN
		#	%	#	%	#	%	#	%	#	%	%	#	
18-20.....	12	4	33.33	6	50.00	0		2	16.67	0		16.67	0	
21-24.....	99	19	19.19	64	64.64	1	1.01	9	9.09	6	6.06	15.15	0	
25-29.....	154	41	26.62	88	57.14	3	1.95	18	11.69	4	2.60	14.29	0	
30-34.....	166	48	28.91	96	57.83	0		19	11.44	3	1.81	13.25	0	
35-39.....	161	57	35.40	85	52.80	4	2.49	13	8.10	2	1.25	9.35	0	
40-44.....	129	56	43.41	47	36.43	3	2.33	16	12.40	5	3.88	16.28	2	1.55
45-49.....	103	56	54.37	34	33.01	2	1.94	5	4.85	1	.97	5.82	4	3.88
50-54.....	88	53	60.23	24	27.27	2	2.27	3	3.41	1	1.14	4.55	5	5.68
55-59.....	50	35	70.00	9	18.00	0		1	2.00	0		2.00	5	10.00
60-64.....	54	33	61.11	11	20.37	0		1	1.85	1	1.85	3.70	8	14.81
65 + ...	36	18	50.00	9	25.00	1	2.78	3	8.33	1	2.78	11.11	4	10.81

line on a semi-log grid; from the late 40's onward the rate changes, and this again takes the form of a single logarithmic function. It would appear from this that at least 2 physiological factors are responsible for this phe-

nomenon, and one is set in motion later than the other. When baldness is taken over from the preceding section and plotted on the same chart, it breaks at exactly the same age as graying at the 2 anatomical loci studied. This is the same spot on the age chart at which strength, as shown by the dynamometer squeeze, falls off sharply. Old age, among the Mountain Ghegs, begins to raise its hoary head in the mid-40's.

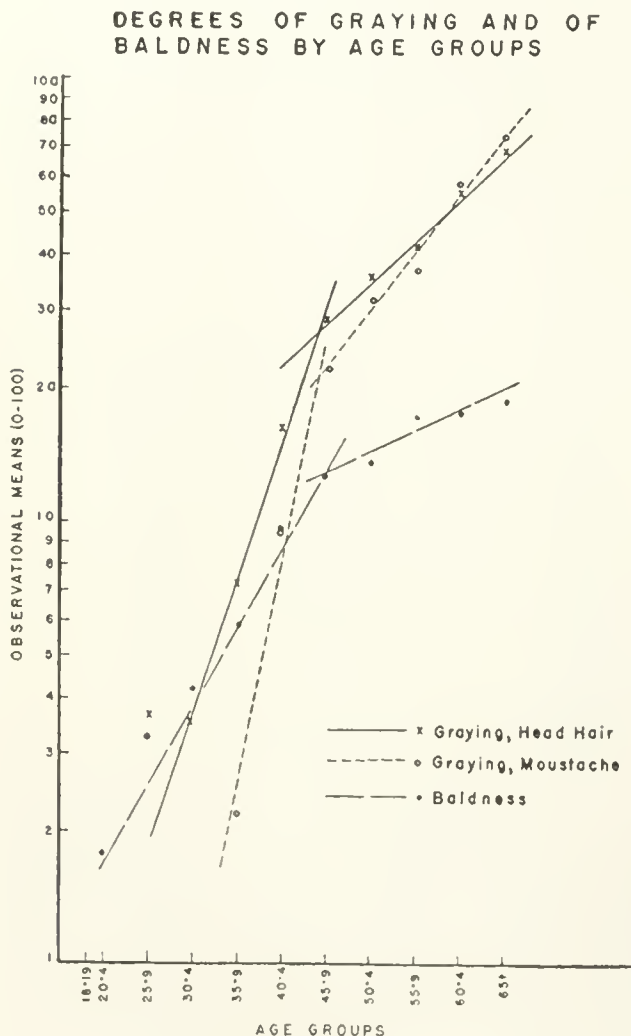


FIG. 6. Age and graying.

AGE AND COLOR CHANGES

In all but 28 (2.6%) cases, it was possible to find enough pigmented hairs with the gray to make a notation for hair color. As table 15 also shows, black hair was more often tied to the higher degrees of graying than any other kind. Black and reddish-brown hair showed much more grayness than the 3 other color categories, all lighter, which tend to form a group. Is this because the black-haired men gray younger than the brown and light-haired men, or because some of them get darker haired as they grow older? While we can never answer this with complete assurance until we have studied chronological changes in the same men, the present evidence favors the second conclusion. Dark brown-haired men are 8 years younger, on the mean, than black-haired men, and this difference reached over 16 times its probable error. Table 15 shows how the percentage of black-haired men increases in each age grade from the early 20's through the late 50's; at that time something happens to reduce the ratio. On the other hand, dark brown-haired men are 3 times as numerous as black-haired in youth; they grow

scarcer with age, until at about age 40 the 2 color brackets are equal, and at age 60 the tables have turned; the black-haired men outnumber the dark brown-haired by over 3 to one. Light brown- and blond-haired men, in general, do not suffer so drastic a reduction. At age 60 both they and the dark brown-haired contingent become more numerous. By age 60, most of the men are already quite gray; it looks as if in some cases the darker hair colors began to bleach out at this time. If we were to describe our series on the basis of a sample of recruits at age 20, clearly then one would have to say that the Mountain Ghegs were predominantly brown haired, with blonds and black-haired individuals in equal-sized minor-

the head. In several other characters which were seen to be critical points of intertribal difference, age cannot be as easily eliminated. We have seen that baldness, hair color, and total face height vary considerably with age, and must explore the effect of these changes on our tribal samples.

Two tribes above all others set themselves apart: Dukagin and Has. Between them they monopolize the peculiarities which suggest that the Highland Ghegs are not a homogeneous group of people. These peculiarities, as tracked down in chapter 10, "The Mountain Gheg Phenotype," are the biacromial diameter, the total face height, the form of the chin, the protrusion of the buttocks, the

TABLE 16: AGE CONTROLS IN CRITICAL CHARACTERS.

No.	HAS		DUKAGIN	
	(28)	(114)	(45)	(106)
AGE	30-39	TOTAL	30-39	TOTAL
Biacromial	38.39 cm.	38.30	40.49	40.37
Total face ht.....	125.86 mm.	126.30	123.44	124.15
Chins, bilateral	17.86%	19.30%	35.51%	38.68%
Buttocks, sm	32.14%	42.11%	2.22%	5.66%
Baldness, present.....	28.57%	46.00%	15.55%	20.19%
Eyebrows, lat. ext.				
abs. & sm.....	53.57%	57.90%	11.11%	8.49%
Hair color				
Black	60.71%	61.46%	17.78%	20.75%
Brown	32.14%	22.92%	68.89%	66.04%
Other	7.14%	15.62%	13.33%	13.21%

ities. At age 45, however, black-haired men would be in the majority. It is probably just as true of most other European populations that hair color depends on the age of the sample. Although eye color shows a number of differences in relation to age, none of these are comparable in magnitude to those which we have just discussed, and they do not affect the position of the sample; a description for any age over 20 will give a fair picture of this character for the adult male population as a whole.

AGE AND INTERTRIBAL DIFFERENCES

So far in this chapter most of the studies of age variations have served to show the position of the series as a whole, and to render it comparable with other series. Some of the exercises have had a bearing on intertribal differences. For example, it is clear that the high stature of the people north of the Drin has nothing to do with age, in comparison with their neighbors to the south, and that the same is true of local variations in the dimensions of

presence or absence of baldness, the lateral extension of the eyebrows, and the color of the head hair. Table 16 shows constants for these characters in Dukagin and Has. In each tribe I have segregated the 30-39-year-olds and made separate computations. By equalizing the age distribution we may hope to find out whether the peculiarities are linked to age, or not.

They are not. The 30-39-year-olds of Dukagin are just as much broader shouldered than their age mates of Has, as the total sample. The Has men have longer faces than the Dukagin men, at any age. The Dukagin men have more bilateral chins, fewer lean buttocks, less baldness, more bilateral extension of the eyebrows, and more brown hair, than the Has men, age for age.

These differences are real ones. They are just as great in one representative age group as in the total sample. Has and Dukagin are local populations which differ in these respects from the total series and from each other.

BITE

THE MECHANICS OF DENTAL OCCLUSION

HAVING described the Gheg phenotype, and having witnessed some of the changes wrought in it by the passage of the individual from youth to old age, we move on to study the effect of *function* on one part of the human organism, the entire masticatory apparatus, including teeth, jaws, and the zygomatic arches. Most people believe that muscles can be developed through exercise; this belief supports gymnasia and athletic programs. Muscular development leaves its mark on the bones, which despite their hardness are relatively plastic. Among the most active muscles in the human body are those which operate the lower jaw—the temporals, masseters, and external and internal pterygoids above, and the platysma below. These muscles are exercised not only in chewing and swallowing, but also in talking. Their strength is surprisingly great; a device used by dentists to measure bite-force records 35 pounds pressure per bite as an ordinary chew, American style.¹ The effective strength which can be exerted depends on a number of factors, including the actual power of the several muscles, the details of the leverage, and the number, position, size, and condition of the teeth. These factors vary with race, sex, age, health, and use.

According to the prevailing theory, a normal human being, after cutting his baby teeth, starts out with a slight overbite. His upper incisors lap slightly over the business edge of his lower incisors. His canines and bicuspids more or less mesh. When he cuts his permanent teeth, this type of occlusion continues. As he grows older, any one of 3 things may happen: (a) the slight overbite continues as his normal adult form; (b) with heavy chewing he forms the habit of moving his lower jaw forward, so that the incisors meet edge-to-edge; (c) with very little chewing he slips his lower jaw backward, and his upper canines and incisors overlap the lower canines and incisors completely. This is what is called a

marked overbite, a condition which parents pay hundreds of dollars to have corrected in their children.

One important factor in this choice of bites is the nature of the articulation of the condyle of the lower jaw; the joint is a very complex one and permits a large amount of motion forward, backward, and sidewise. Thus whichever way you choose to bite, the versatile mandibular fossa makes accommodations, and the teeth take the required positions in the jaws. The act of masticating hundreds of pounds of meat, cereals, and vegetables throughout a person's life must affect not only the foods consumed, but also the teeth. Despite the glassy hardness of enamel, it wears down. The cusps, which serve as the blades of the teeth, or which correspond to the grooves in a millstone, wear flat, under certain conditions. One of these conditions is the consumption of bread stuffs ground in stone mills, and this varies with the kind of stone. If and when the cusps have worn flat, if the bite has become edge-to-edge, then the dental surfaces of the 2 jaws may both be smooth, and a rotary grinding becomes possible. Chewing is never simply up and down; it always includes some side-to-side and fore-and-aft movement, but until the point mentioned above is reached such movements are always limited by the cusps or by the overlap of the front teeth.

It is generally believed that in a mature adult the edge-to-edge bite reflects heavier chewing, all else equal, than the "normal" overbite. The marked overbite is supposed to represent the paucity of mastication associated with eating highly processed foods, and is as characteristic of imperial Roman jaws as of ours. In that it is a byproduct of a technically high civilization it is sometimes called a degeneration. Still another type of bite occurs, the underbite, in which the lower incisors protrude farther forward than the uppers. It is the so-called "bull-dog" bite, an anomaly in any time, place, or population. In our Albanian series we recorded the four types of bite described above.

¹ Baker, 1922, vol. 8, pp. 3-24.

BITE AND AGE

Table 17 shows the relation between bite type and age. The men whose bite was known to be edge-to-edge were nearly 5 years older than their slightly-over kinsmen, and this difference is significant by 9.63 times its own probable error. Disregarding the youngest age bracket as too small a sample, we see that at age 20-24 the percentage of overbites outnumbers that of edge-to-edge occlusions nearly 3 to 1, that the 2 become equal at about age 35, after which the earlier proportions are reversed in the early 50's. The changes in ratio which begin at that age and keep on to senility are a function of the rise in proportion of edentulous men, whose earlier type of bite could not be determined. They are recorded as "un-

Marked overbites are so infrequent that they are statistically almost negligible. They are scattered throughout the age grades in such a way that one cannot say that they are increasing or decreasing, and this accords with what we know of Mountain Gheg eating habits. Underbites are no more or less frequent than expected.

Any notion that types of occlusion are hereditary must be destroyed by this evidence. No genetic infiltration strong enough to affect half the population can have penetrated Ghegania during the lifetime of our oldest subjects. Occlusion is functional, but is all of the change shown in this series a normal age shift from over to edge-to-edge, or can some of it be due to changes in foodstuffs and eating habits, such as the introduction of sugar, and possibly the

TABLE 17: BITE AND AGE.

MEAN AGES IN YEARS

	No.	MEAN
Under	14	35.55 years
Edge-to-edge	521	41.53 $\pm$.31
Slightly over.....	480	36.78 $\pm$.35
Marked-over	10	38.00

PERCENTAGES OF BITE TYPES IN AGE GROUPS

AGE	UNDER	EDGE-EDGE	SLIGHTLY- OVER	MARKED- OVER	UNKNOWN	No.
18-19.....	0	6 50.00	5 41.67	1 8.33	0	12
20-24.....	3 3.03	26 26.26	69 69.69	1 1.01	0	99
25-29.....	0	63 40.65	91 58.71	1 .65	0	155
30-34.....	5 3.01	74 44.58	85 51.20	2 1.20	0	166
35-39.....	2 1.23	84 51.53	75 46.01	1 .61	1 .61	163
40-44.....	1 .78	66 51.16	57 44.19	1 .78	4 3.10	129
45-49.....	1 .97	65 63.11	35 33.98	0	2 1.94	103
50-54.....	1 1.14	59 67.05	23 26.14	2 2.27	3 3.41	88
55-59.....	1 1.96	29 56.86	14 27.45	0	7 13.73	51
60-64.....	0	32 57.14	14 25.00	1 1.79	9 16.07	56
65 + ...	0	17 41.46	12 29.27	0	12 29.27	41
?	0	3 75.00	0	0	1 25.00	4
Total	14 1.31	524 49.11	480 44.99	10 .94	39 3.66	1067

known." Incisors that have been worn enough to breach the pulp cavity are more likely to drop out than those that have not, and hence it is reasonable to suppose that most of the "unknowns" of the later age grades had had edge-to-edge bites, but we cannot be sure. It is also reasonable, but uncertain, to suppose that men who have retained overbites until age 52 will do so for the rest of their lives. By adding the "unknowns" to the edge-to-edge category on table 17, we obtain an expression of this hypothetical progression.

transportation of soft bread from town bakeries to the villages? I leave the answer to this question to the experts in the dental field.

BITE AND GEOGRAPHY

Table 18 gives the tribal distribution of bite types. In this feature the tribes vary greatly, and some of the differences are highly significant, as for example that between Mirdita and Luma in edge-to-edge, which runs to 6.48 times p.e. Mirdita is by far strongest in edge-to-edge, which seems in general to go with the

most remote geographical fastnesses, except for Has. With the same exception, the north-eastern tribes are highest in slight overbites. One might at first suppose that the Catholics were the edge-to-edge people, but in 5 out of the 6 tribes where both faiths are followed, the Moslems have a higher edge-to-edge ratio. In the sixth, Malsia e Jakovës, the Catholics

What this distribution seems to show more than anything else is that slight overbites tend to favor the big eastern market towns and the center of the Roman road. Puka lies at the middle of this road, and Puka has a commercial bakery. Luma has several at Kukës, and others do business at Prizren and Peshkopia. These commercial bakeries turn out a softer product

TABLE 18: BITE.
TRIBAL DISTRIBUTION OF TYPES

	TOTAL	UNDER		EDGE-TO-EDGE		SLIGHTLY OVER		MARKED-OVER		UNKNOWN	
		#	%	#	%	#	%	#	%	#	%
Total Series	1067	14		524		480		10		39	
MeM	105	2	1.90	56	53.33	43	40.95	0		4	3.81
Duk	106	0		60	56.60	46	43.40	0		0	
MeJ	104	2	1.92	35	33.65	67	64.42	0		0	
Has	114	3	2.63	73	64.04	30	26.32	1	.88	7	6.14
Lum	109	1	.92	31	28.44	68	62.39	4	3.67	5	4.59
Puk	102	4	3.92	37	36.27	59	57.84	1	.98	1	.98
Mir	101	2	1.98	70	69.31	19	18.81	2	1.98	8	7.92
Zad	105	0		49	46.67	51	48.57	0		5	4.76
Mat	104	0		51	49.04	51	49.04	0		2	1.92
Dib	108	0		58	53.70	42	38.89	2	1.85	6	5.56

BITE AND RELIGION

	CATHOLIC		MOSLEM		BOTH OTHERS	PROPORTIONS OF E.-E.—S.-O.	
	E-E	SL.-O.	E-E	SL.-O.		CATH.	MOSLEM
MeM	27	23	29	20	6	54	59
Duk	60	46	0	0	0	56	—
MeJ	9	7	26	60	1	56	70
Has	8	3	65	27	11	67	71
Lum	0	0	31	68	10	—	31
Puk	11	24	26	25	6	44	52
Mir	70	19	0	0	12	79	—
Zad	45	42	4	9	5	52	31
Mat	4	6	47	45	2	40	51
Dib	0	0	58	42	8	—	58
Intertr.	2	2	7	7	2	50	50
Total	236	172	293	303	63	1067	49

form a special regional population, that of Nikaj and Merturi, just over the divide from Shoshi and Shala. Bite cannot be shown to have anything to do with ritual food taboos at all. Nor should one expect this, for the chief difference in diet lies in the species of animal eaten, while the food that takes the most chewing, bread, is the same for both in any given region.

than home ovens, at least in my experience.

Why then, has Has one of the highest ratios of edge-to-edge bite, when the very men measured at Has were drawn from villages of hereditary commercial bakers? The answer to this lies in the age distribution. Twenty-eight men of the Has sample fell into age group 30-39. Of these, 13 had edge-to-edge bites, 14 slightly-over, and one marked-over. The

edge-to-edge ratio for this age grade is 48. In Luma, which stands at the other end of the scale in bite form, 25 men in the same age grade had 11 edge-to-edge, 13 slightly-over, and one under. This gives a ratio of 46. If one counts marked-over with slightly-over and under with edge-to-edge, the ratios are reversed. The bakers were simply older men.

Much more research needs to be done if we are to explain the incidences of kinds of occlusion among Mountain Ghegs. All this report can possibly accomplish is to serve as a reconnaissance for specialists.

BITE AND FACE HEIGHTS

We have seen in chapter 11, "Age," page 74, that unlike most other parts of the body, the face keeps on growing throughout life. In old age, however, this growth is often offset by the deterioration and loss of the teeth. As the teeth wear down and drop out, the dental borders of both maxillae and mandible shrink through absorption, and the chin and nose approach each other. These compensatory processes, face growth and dental attrition, do not necessarily move apace. Among some individuals the teeth remain sound until late in life; in others they deteriorate early. These differences thus affect not only means but also dispersions and measures of variability, including the probable error. In a series which includes a large percentage of men who have reached middle age, or in one in which poor teeth are common at any age, some method must be found to eliminate this source of error. Being aware of this problem before leaving for Albania, I included in the measurement blank the observations *face shortening due to wear*, and *face shortening due to loss and absorption*. It was easier to observe dental condition with this problem in mind than to make general

observations and then try to estimate the effect on face height later.

Table 19 tells us the rest of the story. Shortening from wear went largely with the edge-to-edge type of bite, while loss and absorption were more characteristic of men who had had overbites, and whose teeth were less worn, in the instances where enough teeth were left to tell. In only 5 instances was it possible to attribute the shortening to both. Shortening due to wear set in 10 years earlier than that due to loss and absorption. The total face height means of the men who had suffered shortening from wear were significantly smaller than the total mean, in the + and ++ categories; the same was true of those subject to loss and absorption, in the ++ category only. In the case of the upper face height means, it was the men who had undergone loss and absorption who suffered the greater reduction, significant in both + and ++ categories. On the basis of these figures it seemed wiser to eliminate from the seriations of total face height, upper face height, and the dependent indices, the 164 men recorded as + or ++ in either loss category. With this correction the seriations given on table 4 were computed. The rejects came mostly from the older age grades, and no more than 22 per cent were removed from any one tribe.

One other question remains to be explored: whether, when wear, loss, and absorption are eliminated, the type of occlusion affects face heights. One might suppose that if 2 men had identical facial skeletons and identical teeth, and one man had an overbite while the other's teeth met edge-to-edge, the latter would have the longer face. As the last part of table 19 shows, this is not the case. Occlusion has no qualifying effect whatever on face lengths, except through wear, loss, and absorption.

TABLE 19: BITE, AGE, AND FACE SHORTENING.

Shortening, if any, due to:		FACE SHORTENING, FREQUENCIES						Grand Total
		abs.	ssm	sm	+	++	+++	
Wear	808	4	162	66	21	1	(254)	1062
Loss	1006	1	4	25	23	3	(56)	1062
Both				1	3		(5)	5
Loss + Wear								
(Neither)	..	(752)					(752)	
Total	923*				164			1067
	kept				removed			

(*Of 923 left, 921 have face heights.)

THE MOUNTAINS OF GIANTS

TABLE 19 (*continued*)

AGE			X P. E. FROM ABS.-ABS.
No.	MEAN (YRS.)		
No wear, no loss.....	750	36.26 ± .28	
Abs.-Abs.			
Wear: ssm & sm.....	161	43.24 ± .60	10.58
+	67	48.08 ± 1.29	8.95
++, +++	25	53.50 ± 1.12	15.00
Loss: ssm, sm, + ...	31	53.29 ± 1.16	12.00
++, +++	29	55.28 ± 1.00	18.33

FACE LENGTHS AND FACE SHORTENING ON THE BASES OF
(A) WEAR, AND (B) LOSS AND ABSORPTION

TOTAL FACE HEIGHT									
WEAR					LOSS & ABSORPTION				
	No.	MEAN	σ	Δ	X P.E. No.	MEAN	σ	Δ	X P.E.
Total	1065	123.25 ± .14	6.75	—	—1065	123.25 ± .14	6.75	—	—
sm	163	122.95 ± .25	5.35	.30 ± .36	.84 4	128.00	—	—	—
+	67	121.55 ± .63	7.60	1.70 ± .55	3.09 27	122.35 ± .29	2.20	.90 ± .88	1.03
++	25	120.80 ± .76	5.65	4.15 ± .69	6.02 26	117.40 ± .81	6.00	5.85 ± .89	5.75

UPPER FACE HEIGHT									
WEAR					LOSS & ABSORPTION				
	No.	MEAN	σ	Δ	X P.E. No.	MEAN	σ	Δ	X P.E.
Total	1065	73.25 ± .11	5.20	—	—1065	73.25 ± .11	5.20	—	—
sm	162	73.35 ± .27	5.05	.10 ± .28	.36 4	77.00	—	—	—
+	67	72.05 ± .47	5.75	1.20 ± .43	2.79 27	70.70 ± .72	5.55	2.55 ± .67	3.81
++	25	72.60 ± .69	5.15	.65 ± .70	.93 26	69.10 ± .73	5.55	4.15 ± .69	6.02

DENTAL REJECTS							
		% OF			% OF		
AGE	No.	WHOLE	TRIBE	No.	WHOLE		
18-19.....	0	0	MeM	23	21.9		
20-24.....	1	1.1	Duk	5	4.7		
25-29.....	2	1.3	MeJ	9	8.7		
30-34.....	3	1.8	Has	23	20.2		
35-39.....	11	6.8	Lum	10	9.2		
40-44.....	18	14.0	Puk	11	10.8		
45-49.....	18	17.5	Mir	22	21.8		
50-54.....	27	30.7	Zad	8	7.5		
55-59.....	22	42.3	Mat	11	10.6		
60-64.....	19	33.9	Dib	23	21.3		
65	25	61.0	Intertr.	3	2.8		

FACE HEIGHTS AND BITE TYPE
Means of the Corrected Series

EDGE-TO-EDGE				SLIGHTLY-OVER	
	No.	MEAN		No.	MEAN
Total face height.....	430	123.40 ± .21		461	123.95 ± .20
Upper face height	430	73.60 ± .16		461	73.50 ± .16

BITE AND FACE BREADTHS, WITH RELATED CHARACTERS

It is possible, however, that factors in occlusion may be concerned with face breadths. A progressive development of the temporals, masseters, and pterygoids might well bring about an increase in the bowing and flare of the zygomatic arches, reflected in the bizygo-

sponding age group. Face breadth increases 3 to 4 millimeters during adult life, up to the late 50's. This increase appears to be concentrated among the men with edge-to-edge bites; most of the men with overbites are younger. Although use and growth seem to go together, one cannot of course point definitely to a causal relationship. One can only suggest it as a likelihood worthy of experimental testing.

TABLE 20: THE BIZYGOMATIC DIAMETER, BITE, AND TOOTH WEAR.

	No.	MEAN (MM.)	AGE (YRS.)	AGE MEAN (MM.)
Overbites	490	141.84 $\pm$.24	36.78	142.65 $\pm$.27
Edge-to-edge	524	142.82 $\pm$.24	41.53	142.85 $\pm$.30
E-E abs. wear.....	275	141.32 $\pm$.22	36.26	142.65 $\pm$.27
E-E ssm-sm wear	162	143.05 $\pm$.31	43.24	142.85 $\pm$.30
E-E + wear.....	64	142.39 $\pm$.57	48.08	143.20 $\pm$.37
E-E ++, +++ wear.....	23	144.18 $\pm$.75	53.50	143.09 $\pm$.43

matic diameter. Table 20 contains relevant statistics. In general, men with edge-to-edge bites have slightly wider faces than men with overbites, but the difference is 2.83 times p.e. only, a little short of significance. The fact that the men with overbites were 5 years younger than the others links this to age. It is not to be expected that bite alone should be related to face breadth, but rather the amount of pressure used with different kinds of bite, and this pressure can best be measured by its effect on the teeth, i.e., wear. In the edge-to-edge category, the bizygomat mean increases, although not regularly, with the amount of wear. Two out of 3 of these increases over the means of the absent wear category are significant. The men grouped by wear categories also differ, however, in age, and the bizygomat mean for each wear category follows closely that of the corre-

Whatever the reason, our Ghegs are 3 or 4 millimeters wider in the bizygomat diameter than a series of genetically similar younger men would be. This should be considered in interseries comparisons.

In order to test effect of bite further, serializations similar to those for the bizygomat were made for the bigonial diameter. No differences were found; this dimension does not even increase with age. The observations on the forward and sidewise jut of the malars and in the fullness of the cheeks were further tested for bite properties, also without showing difference. In these respects the phenotype needs no qualification, except in one sense: the triangularity of the lower face suggested by the relative widths of the bizygomat and bigonial diameters must increase with age. Again the typical Dinaric is an elderly individual.

SOIL

SOIL AND GROWTH

THAT the content of the soil influences the growth of populations who live off its produce has been often claimed and nearly as often denied. Without reasonable doubt it is one factor in the development of body size in man, as in other animals. Boas showed this years ago in his work on the children of immigrants¹ and, in works on this subject, Matheny and Meredith have shown that Italian schoolboys brought up in Minnesota reach, at the age of 17, a mean stature of 171.1 centimeters, a figure far above any adult mean reported for Italy.²

In northern Albania we have found tribal stature means differing from each other a little less than 7 centimeters on comparable adult stature groups. This is not too much for genetically similar populations if they are reared under vastly different conditions of nutrition. If one reviews the earliest anthropometric surveys of Switzerland,³ one finds equally great differences between isolated valleys in some of the cantons; surveys made a half century later, after modern methods of food distribution, and modern sanitation, had been introduced, showed a much more uniform stature map. In these respects Albania was certainly in no more favorable a position in 1929 than Switzerland in the 1880's.

We obtain our nutrition from the soil through the agency of vegetable matter, and from the meat as well as the milk of animals which are fed upon the same. One of the most obvious minerals to be considered is lime, needed for the growth of bone; but how much lime we need, and how much of that which is in the soil reaches us, is not known. In recent years much attention has been paid to the trace elements,⁴ needed for various metabolic processes, but this subject too is little known. We are told that chemical fertilizers fail to put back the trace elements taken from the soil, and that manure is far better.⁵

Too little is known about the soils of northern Albania to permit a detailed study of their relationship to physique, but we can find to what extent pertinent anthropological features fit the geological picture. The latter has already been described in chapter 2, "Land of the Highland Ghegs," and the principal geological areas blocked out, after Almagià on figure 2.⁶

The Mesozoic limestone of Malsia e Madhe, Shala, and Malsia e Jakovës is a southern continuation of the barren karst of Montenegro. Although it is a poor country for farming, and much of it is good only for grazing goats, the people on both sides of the border, though often hungry, are large and heavy boned. The serpentine highland zone, in contrast, which runs all the way from eastern Malsia e Madhe across most of Puka, all of Mirdita, and parts of Zadrina, Mati, and Dibra, is in places forested. The soil is reminiscent of that seen on certain worn-out farms of northern New England. The eastern zone of Metamorphosed Triassic and Upper Palaeozoic rocks supports open meadows and brown-soiled fields, with forests on the slopes and clumps of poplars around the villages.

These are the 3 principal geological areas. To them may be added the area of intense folding of Mesozoic-Eocene strata, along both sides of the Drin in Shoshi, Nikaj, and the northern villages of Puka. The traveler walking along the Roman road can see where the river has cut sections through the strata in several places, revealing contorted patterns, including one in the shape of a figure S. In north-central Mati a cap of tertiary limestone breaks the continuity of the gabbro. No village is situated directly over it, but the goats and cattle from several villages are driven onto it for summer grazing, and the villagers drink their milk and eat their flesh. Finally, a small slice of the tillage land of Zadrina is included in the so-called Dalmato-Montenegrin num-

¹ Boas, 1911; 1912, pp. 530-62.

² Matheny and Meredith, 1947, pp. 344-55.

³ Schlaginhaufen, 1946, text and atlas; Coon, 1939, pp. 550-52, and Ripley, 1899, pp. 281-89, for discussion and sources.

⁴ Stiles, 1946.

⁵ Howard, 1947.

⁶ Almagià, 1932, map on p. 467.

mulithic limestone and flysch, extending southward from the isthmus between Lake Scutari and the Adriatic.

These 6 areas correspond roughly to the tribal divisions, but some of the geological boundaries cut across tribes. From the tribal data alone a close relationship between geology and physique is suggested; if we reseriate by geological areas, ignoring tribal affiliations, we can test this more accurately.

SOIL AND PHYSIQUE IN MALSA E GHEGNISE

Samples for each of the 3 major areas and the area of folding range in size from 126 to 354 individuals. To the flysch section of Zadrime, 41 men can be assigned. Only in the small limestone region of Mati is the sample, 13, statistically inadequate. In table 21 the means for these 6 tribal samples in 12 pertinent measurements are given. In general, they repeat the picture shown by tribal distribution, and in certain respects accentuate it. When we compare the first 5, making 15 comparisons for 12 characters, we find 65 out of a possible 180 differences significant, or 36 per cent; 28, or 16 per cent, are more than 6.00 times p.e.; 14, or 8 per cent, over 8.00 times p.e.; and 6, or 3 per cent, over 10.00 times p.e. The means for the areas do not in themselves exceed tribal means, because the areas are spatially more inclusive than single tribes situated within them. They fall between the tribes and the total series in variability, as indicated on table 21 by values of σ . Each of the geological areas undoubtedly contains a number of small local enclaves, as Switzerland did during the last century. To find lower values for σ we would have to study these valleys, and the villages in them, one by one. Our sample is not large enough for such fragmentation.

The validity of the division of the total series into geological areas is most clearly shown by the figures on the third part of table 21, in which the stature means of the component segments of tribes falling in each geological area have been listed together. In every case but one, *the means of the segments of individual tribes diverge from each other in the directions of their areal means, and they resemble these areal means more closely than they do each other.*

The one exception is Malsia e Jakovës, divided between limestone and folded. These 2 areas are nearly the same in stature, and the difference between tribal segments is inconsequential. The 4 other men from this tribe who lived in serpentine territory were much shorter, 168 centimeters. Not only were the men from serpentine territory short as a whole, but very few of the exceptionally tall men, the "giants" of 180 to 190 centimeters from whom the Ghegs get their name, are found among them. These striking figures are seen almost exclusively north of the Drin. A few turn up near the limestone area of northern Mati, where a small sample suggests that a tall enclave may be found.

From a statistical standpoint, the most telling division within a tribe is that which splits Dibra into serpentine and eastern subsamples. The difference between the means, 3.07, is 3.49 times p.e. In order to test this for the possibility of a genetic difference I selected the one character in which Dibra is most distinctive, light brown eye color, and sorted the subsamples for it. Out of 15 men whose eyes were of this hue, 7, or 19 per cent, were from serpentine territory, and 8, or 11 per cent, from the eastern. Neither the rest of serpentine nor the rest of eastern approach these frequencies. In this character, which is certainly genetic, Dibra is still a unit, still separate from its neighbors.

Although fragmentation of the series is unprofitable because of the smallness of the subsamples, one example may show what kind of thing to expect when the local enclaves can be investigated. In Dukagin, as stated earlier, mutual exogamy, with cross-cousin marriage, is the rule between the people of Shala and Shoshi. However, many of the Shala men marry Shala women, who come from the families of *amas*, unrelated in the male line to the *fis* of Dukagin. In Shoshi also local endogamy takes place, but more rarely. Shala is apparently in the limestone, Shoshi in the folded, area. Shala men whose mothers came from Shoshi are 4.04 centimeters taller (see table 21, last part) than Shala men whose mothers were local, and this difference is 5.53 times its p.e. At the same time Shala men with Shoshi mothers are 3.37 centimeters taller than their cousins, the Shoshi men with Shala mothers, and this comes to 2.88 times p.e.

The people living in the northern limestone area are not only taller than the others, but also wider spanned, broader shouldered, and stronger. They are, in general, bigger and more robust. The inhabitants of the folded region approach them in build, while the serpentine dwellers are small all over, but partic-

ularly in their arms and legs, and the flysch-folk are the smallest of the lot. Whether or not it is of any consequence, the last-named live on the border of malarial country.

The inhabitants of the eastern area fall close to the mean of the total series in the measurements and dimensions of the body, but diverge

TABLE 21: ANTHROPOMETRIC MEANS AND GEOLOGICAL AREAS.

	TOTAL	FLYSCH	LIMESTONE	FOLDED	SERPENTINE	EASTERN	MAT. L.
Squeeze	112.09	102.95±1.94	116.55±.79	111.95±1.20	105.55±.73	110.70±.74	102.33
(No.)		(41)	(237)	(126)	(354)	(294)	(13)
Stature	169.71±.14	165.87±.80	173.04±.27	171.87±.34	167.22±.22	169.92±.26	167.55
Rel. span ...	103.94±.05	104.74±.30	104.58±.12	104.00±.14	103.22±.10	103.56±.11	101.88
Rel. sh. br..	22.76±.02	22.55±.12	23.08±.05	22.76±.08	22.66±.05	22.68±.05	23.42
Rel. sit. ht..	52.76±.03	53.67±.19	52.55±.06	52.59±.09	52.91±.06	52.76±.07	53.12
Head lgth...	186.18±.15	181.47±.57	188.12±.29	188.76±.44	184.32±.24	186.21±.26	187.88
Head br. ...	157.78±.12	157.44±.56	159.92±.26	157.38±.33	157.88±.21	156.57±.24	155.85
Head ht. ...	128.34±.12	128.63±.67	128.67±.26	129.08±.33	128.22±.17	127.95±.24	123.69
Ceph. index	84.84±.09	86.71±.40	85.17±.18	83.34±.25	85.59±.15	84.18±.17	83.07
(No.)	(921)	(39)	(204)	(115)	(298)	(252)	(7)
Tot. face ht.	123.90±.14	122.00±.72	124.80±.31	121.85±.44	122.60±.24	126.45±.33	126.40
(No.)	(921)	(39)	(204)	(115)	(298)	(252)	(7)
Up. face ht.,	73.55±.11	71.25±.57	73.75±.23	72.20±.30	73.10±.19	74.95±.21	72.00
Bizygomatic	142.35±.12	140.90±.65	144.05±.22	142.50±.32	141.70±.19	141.80±.21	139.30

VALUES OF σ FOR AREAS, TOTAL SERIES, AND TRIBES

	FIVE AREAS	TOTAL	TRIBES
Stature	6.44	6.72	6.38
Rel. span	2.67	2.56	2.48
Rel. shoulder br.....	1.26	1.20	1.16
Rel. sitting ht.....	1.60	1.50	1.46
Head lgth.....	6.59	7.08	6.65
Head br.	5.72	6.00	5.67
Head ht.....	6.04	6.03	5.87
Cephalic index.....	4.12	4.29	4.03
Total face ht.....	6.83	6.50	6.29
Upper face ht.....	4.95	5.00	4.89
Bizygomatic	5.49	5.65	5.80

STATURE MEANS FOR GEOLOGICALLY SEPARATED SEGMENTS OF TRIBES

LIMESTONE	FOLDED	SERPENTINE	EASTERN	FLYSCH
MeM 105 172.77	Duk 20 173.20	Puk 40 168.25 ± .72	Has 113 170.82	Zad 34 165.72
Duk 78 174.36	MeJ 48 172.87	Mir 101 166.68	Lum 109 169.47	
MeJ 52 172.48	Puk 57 170.23 ± .47	Zad 70 167.72	Dib 74 169.53 ± .52	
	Puk* 13 170.85	Mat 92 166.68		
Mat 12 168.25		Dib 35 166.46 ± .71		

* Thirteen men from the village of Puka, eating bread from a bakery which uses flour from all parts of the tribe.

STATURE MEANS INSIDE DUKAGIN

FATHER	MOTHER	No.	MEAN
Shala	Shala	48	172.83
Shala	Shoshi	30	176.87 ± .46
Shoshi	Shala	16	173.50 ± 1.08
Shoshi	Shoshi	4	171.98

from all the others in the measurements of the head and face. These people are, compared to the others, notably narrow headed, narrow faced, and long faced.

Head form (figs. 14, 15) follows the same distribution shown by the tribes. The one measurement that does not vary at all significantly is head height. Head length, however, shows the greatest variation of any character recorded. Computing a cephalic module from the means,⁷ we find the areas clustered into 2 groups, limestone and folded, with 158.90 and 158.41 centimeters respectively, and flysch, serpentine, and eastern with 155.65, 156.71, and 156.91; big heads and medium to small heads. The size of the head, within a major racial group of man, goes with the volume of the body.⁸ In a series like ours where the dimensions of the head are subject to great variation of questionable origin, head size is a more useful criterion for the purpose of this chapter than its components. It clearly separates the Mountain Ghegs into 2 categories, one large, the other medium to small.

This, rather than the individual measurements and indices, is the most suggestive difference yet found between regional segments of the total series. The people in the limestone karst country are big people, and their kinsmen in the country where the soil is laid on a medley of folded outcrops are nearly as big. The people living in the land of serpentine and gabbro are much smaller, as is the small sample of flysch-dwellers. To the east, in the valley of the Black Drin and up into the Prizren region, the people are of intermediate stature, but with relatively long, narrow heads and faces.

In addition to the data presented, sortings were made for a number of observations which might have to do with general robusticity. This effort yielded nothing that the tribal sortings have not already revealed. No difference was found between areas in the proportion of concave scapulae, which seem to have more to do with age than with nutrition. Finally, the teeth of all areas were seen to be equally carious, equal in frequency of evulsion.

PRIVILEGE AND NUTRITION

In many countries food and other benefits are unequally distributed, and in some of them

members of the privileged classes are taller than their less-favored fellow citizens. In the mountains of the Ghegs no stereotyped class system exists. Nevertheless in each tribe a few men hold higher political rank than the others, and a little difference in wealth may be discovered. Wealth and power usually go together. Using the data discussed in chapter 5, on "Politics and Feuding," page 30, I have segregated 66 office-holders, 23 from limestone territory, and 43 from serpentine. The latter group included the entourage of Prince Jon Markajon (fig. 10, *a*), the tribal chief of Mirdita. These men had eaten the best the land had to offer. As table 22 shows, this made no real

TABLE 22: GEOLOGY AND STATURE,
OFFICE-HOLDERS.

	LIMESTONE		SERPENTINE	
	No.	MEAN	No.	MEAN
Total	237	173.04	354	167.22
Office-holders ..	23	174.09	43	167.63

difference in stature. In the mountains a chief eats at a big table, surrounded by his retainers, but any visitor is free to join at the hospitable board. The office-holders probably get more meat than the poorer people, but everyone consumes dairy products, bread, and legumes. Everyone also derives all his food from the same geographical source.

CONCLUSION

Although the geological map on which this study is based was of a most general character, it seems to have been accurate enough for the present purpose. The minerals of this region which it shows can be correlated with the body size and robusticity of the inhabitants as populations, and with nothing else which this particular study reveals, other than a partly coincidental east-west trend in head and face form, which will be discussed later. What minerals, if any, are involved in these size variations, how they are assimilated, if they are, and how they affect growth, if they do, are problems beyond the scope of this paper and its author's competence. If this excursion into the nutritional field has any value it lies in the fact that other explanations of regional size differences have been eliminated.

⁸ Coon, 1939, p. 267.

⁷ Cephalic module = $\frac{L+B+Ht.}{3}$

CRADLING

THE EVIDENCE ACCUMULATES

I WROTE, in 1939, "There has been much discussion upon the subject of occipital flattening, both in Albania and in Asia Minor; there are two definite schools, one which believes that it is natural and racially determined, the other that it is a form of artificial deformation caused by cradling. My own position lies between these two extremes; occipital flattening is without doubt a phenomenon associated with the entire mechanical orientation of the cranium in the Dinaric race, and especially with the position of the foramen magnum to the rear of that usual in most races. As such, it is undeniably inherited.

"At the same time, the use of the Albanian cradle, in which the shoulders are bound but the head is not, may in some instances have caused an intensification of this flattening, since the heads of some living Albanians are unquestionably deformed. However, since cradling practices are regionally uniform in Albania, the geographical distribution of this character is wholly racial in pattern."¹

I also promised in a footnote: "A detailed study of this question will be published in the author's 'The Physical Anthropology of Northern Albania,' the provisional title of the present monograph. Since then evidence has been accumulating that 'some instances' should be changed to 'most instances.'" Father Ewing found that Lebanese children born in Brooklyn show much less flattening than their parents, and 2 Harvard graduate students, Mr. David de Harport and Mr. William Laughlin, working under my direction, found the same thing among Tosks in Greater Boston.²

In the course of the present monograph 6 pieces of evidence have appeared in other contexts. In chapter 10, on "The Mountain Gheg Phenotype," on page 62, and table 4, we saw that the sigma ratios for head length, head breadth, and the cephalic index are abnormally high, both as a total and within tribes, and this applies especially to the cephalic index.

In the same chapter, on page 63, it appeared that the tribal means differ more from each other and from the total means in these 3 characters, and in the breadth-height index, than in any other criteria except for the gross body diameters, of which we have already tentatively disposed in chapter 13, on "Soil."

In the same chapter, on page 66, we found that the tribes differ from each other most notably and significantly in 7 observations of the cranial vault, especially in bathrocephaly, occipital flattening, and lambdoid flattening. We further saw that the frequencies of degrees of flattening assumed the form of a normal curve quite independent of the "absent" category. If flattening were natural one would expect *sm* to exceed +, + to exceed ++, etc., in frequency.

In chapter 11, on "Age," page 77, it was revealed that the head length fails to follow the normal or expected age changes, but that the head breadth bellows out and in with age, doing double duty. In chapter 13, on "Soil," page 89, head form was shown, in a general way, to follow its own geographical course without regard to the soil-area divisions which so firmly mark frontiers of physique in the sizes of the body as a whole and of the head.

Any one of these red lights flashing through the chapters would have been enough to warn us that something is peculiar about head form in this series. In fact, there are no green lights; in no segment of this study has the cranial vault behaved as one expects in a normal population. "Normal" in this sense refers to the large series studied in the past, and most of these have been from western Europe and modern America. It will probably be shown as time goes on that many of the peoples of the world have heads comparable to those of the Albanians. We know already that this is true of Armenians, Lebanese, and Montenegrins, and it can probably be demonstrated for other European populations.

¹ Coon, 1939, p. 600.

² Ewing, 1947, pp. 235-36; Ehrich and Coon, 1948, pp. 181-86.

The literature of the entire subject of cranial deformation has been ably covered by Dingwall,³ who quotes some Albanian instances in which intentional molding was observed. Miss Hasluck confirms this for Macedonia, and has a paper on the subject for Albania in preparation.⁴ It is hard to say how much of the cranial deformation in Albania is intentional, and how much the unconscious result of cradling.

THE TECHNIQUE OF CRADLING

Albanian mothers, like mothers in other countries, are often faced with a "baby-sitter" problem. A young woman wants to go out in the fields to work, or to the market for shopping, and she cannot leave her baby alone. Besides, if she is to be gone for any length of time she must have her baby with her to nurse it. When she is on the march she cannot afford to immobilize her hands by carrying it in her arms. Walking-time is spinning-time in Albania. These are some of the practical reasons for a cradle. Other reasons are emotional and historical. The cradle is a part of Albanian culture, like the hearth and the loom—one of the material symbols of the activities of men, women, and children in families. Our grandfathers were cradled, and our grandfathers were wise and generous men, and brave warriors.

After he has been washed, blessed, and swaddled, the baby is laid in the cradle, which is lined with soft blankets. A thin pillow protects his head from the wood. There may be some variation on this point, as to how thin and how soft the pillow is. Once on his back, the baby is bound to the cradle-board at the shoulders and also lower down. This keeps him from moving about, and his shoulders stay flat. He can move his head about as much as this position will allow. Although the head is not bound, its easiest position in rest is squarely on the occipital bone.

The child rides and nurses and sleeps in this cradle most of the time until he is taken out for good, which is said to vary between 6 months and a year, or even longer. During this period it is changed from swaddling

clothes to garments which permit freer movements. When the time for uncradling draws near, the mother takes the child out now and then to see if it can sit up; when it is able to sit by itself on a blanket while she works, she may remove it from the cradle altogether.

Armenian as well as Albanian informants tell me that 2 factors govern the age at which the child is uncradled: its "strength," or ability to "sit up without falling down," and the preference of the parents. A "strong" baby, therefore, would be released earlier in life than a "weak" baby, and a difference between a year's cradling and 6 months' might make all the difference between no visible flattening and an extreme case. One is also tempted to postulate that a "strong" baby's bones would resist deformation more than those of a "weak" baby, particularly if weakness were a reflection of nutrition in a hungry land, as in many parts of the Gheg mountains. When parental choice is added, we find reasons enough to explain variations in the frequency of flattening.

Thanks to the generosity of Mr. Dmitri Peterson of Somerville, Massachusetts, we have a scale model of such a cradle to study first hand. Mr. Peterson was taught the trade of carpenter in Albania as a young man, and has made many such cradles. Although his home was in southern Albania, my photographs and memory of Gheg cradles showed them to be much the same. The cradle made by Mr. Peterson consists essentially of 2 boards, a backboard on which the baby lies, and a headboard shielding the top of his head. Other boards form the sides. A footboard, which is the same piece of wood as the front rocker, has been cut crescent-wise to let the baby's feet through. He could, however, brace against it with his feet if he tried.

The cradle depicted in figure 11, *a*, on the other hand, has a sling of yarn for the head to rest on, and only a low headboard. The footboard is low, but straight. This cradle was photographed in Zadrina. Baron Nopesa⁵ illustrates another cradle from "Planti (Gebiet von Pulti)," which I presume is in Malsia e Madhe (fig. 11, *d*). It had a headboard and a

³ Dingwall, 1931.

⁴ Hasluck, 1947, pp. 130-31.

⁵ Nopesa, 1925, p. 109.

curved footboard, like Mr. Peterson's. In Haberlandt's work⁶ 2 are shown, both of the Peterson variety. One was from Scutari (fig. 11, *b*), the other belonged to Vlachs in central Albania (fig. 11, *c*).

Were one to make a detailed study of cradle types in the Gheg mountains, tribe by tribe and village by village, one would probably find variations both in form and in use which might further help explain local differences in head form. It may for example be no coincidence that the Zadrina cradle has no headboard, while the Zadrina sample is high in occipital and very low in lambdoid flattening. It is not inconceivable that a baby who had outgrown his cradle and who had learned to brace his feet on the footboard might push his head against the headboard if there were one, and give himself lambdoid flattening. On the other hand, a slanting pillow might have the same effect.

Sometimes one finds both kinds on the same head; presumably the child was occipitally flattened first, then, as he outgrew his cradle, lambdoid flattening appeared. If during the process of flattening the smooth union of the parietals and the occipital bone were impeded, and an irregular bone growth resulted, the anomaly called bathrocephaly would be added. It is possible that, in some cases, bathrocephaly might be the only discernible after-effect of cradling; that the bones would spring rather than flatten. What is badly needed is some experimental work on this subject; until that is done it must remain partly speculative, since these types of deformation also occur on heads which have not been cradled, in lower frequencies and in less extreme degree.

THE RELATIONSHIP BETWEEN TYPES OF DEFORMATION

On figure 7 the frequencies and percentages of the various categories of occipital flattening, lambdoid flattening, and bathrocephaly have been given. Table 23 shows how these 3 phenomena are related. Less than a third (31.40%) of the men had unflattened heads, and 27 per cent also lacked bathrocephaly.

⁶ Haberlandt, 1917, p. 11, table III, no. 12, and p. 95, fig. 29.

These 27 per cent were undoubtedly cradled like the others; perhaps they were "strong" babies and released early; perhaps they had softer pillows than the others. What caused this difference in each case we do not know.

Of the two-thirds of the men who remain, those who have one kind of flattening seldom have the other. The fourfold table at the bottom of table 23 yields a coefficient of association of $-.69$, which is strongly negative.⁷ The 68 men, or 6 per cent of the series, who

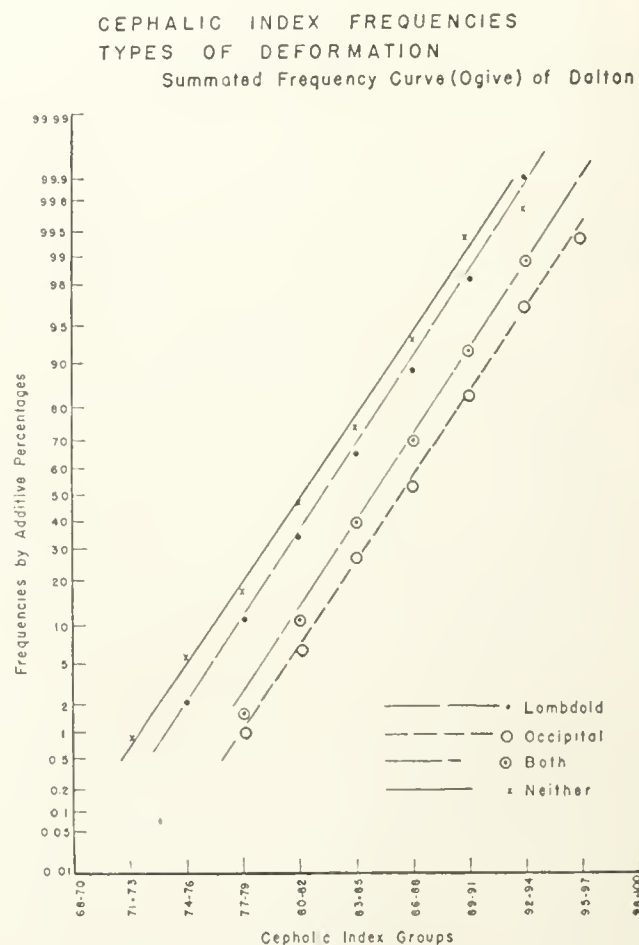


FIG. 7. Cephalic index frequencies.

have both, fail to reach the +++ category in either plane.

Bathrocephaly is closely linked to lambdoid flattening, to the extent of a $+.84$ coefficient of association, so closely that in the rest of this chapter we can, for practical purposes, ignore it. We can afford to do so, however, only

⁷ Yule's formula. $Q = \frac{ad - bc}{ad + bc}$; Arkin and Colton, 1947, p. 100.

after considering the 49 men who had bathrocephaly without any flattening at all. These 49 men have a mean cephalic index of $82.41 \pm .35$, nearly the same as the total of 286 men who had no flattening, $82.97 \pm .15$. It seems fully justifiable to consider them in the latter category.

The evidence of brothers is included here merely to show that neither genetics nor family cradling habits can be shown to govern the presence or absence of the 2 types of flattening. Unless we leave it entirely to chance, the theory of the "strong" child seems most likely.

TABLE 23: TYPES OF FLATTENING.

		OCCIPITAL FLATTENING					TOTAL
		ABS.	SM	+	++	+++	
LAMBDOID FLATTENING	Abs.	335	22	164	66	10	597
	sm	98	8	4	—	—	110
	+	275	7	43	2	—	327
	++	27	—	2	2	—	31
	+++	2	—	—	—	—	2
Total		737	37	213	70	10	1067

BATHROCEPHALY AND FLATTENING

	COMBINATIONS OF FLATTENING		BATHROCEPHALY				TOTAL
	No.	%	ABSENT		PRESENT		
			No.	%	No.	%	
No flattening	335	31.40	286	85.37	49	14.63	100.00
Occipital only	262	24.56	254	97.21	7	2.79	100.00
Lambdoid only	402	37.66	183	45.52	218	54.48	100.00
Both	68	6.38	34	50.00	34	50.00	100.00
Total	1067	100.00	757		308		

		OCCIPITAL	
LAMBDOID		ABS.	PRES.
Abs.	335		262
PRES.	402		68

$$Q = -.69$$

		BATHROCEPHALY	
LAMBDOID		ABS.	PRES.
Abs.	540		56
PRES.	217		252

$$Q = +.84$$

THE EVIDENCE OF BROTHERS

In our series it was possible to identify 13 pairs of brothers and 4 sets of 3. Their positions in respect to presence or absence of the 2 kinds of cranial flattening are shown on table 24.

This table is difficult to interpret, largely because the numbers of individuals are so small. In the pairs of brothers, there seems to be a tendency for both or neither to have flattened skulls, regardless of the type of flattening. In the sets of 3, the numbers are too small to tell anything of consequence except that the same mother may bear sons who differ. In the upper right corner of the table the numbers in parentheses represent the numbers expected in each of the 4 classes if the group of 17 families were a random sample of the whole series. If we combine "lambdoid only" and "occipital only" we see that this is the

*P=present.
†A=absent.

TABLE 24: HEAD FLATTENING AMONG BROTHERS.

	PAIRS OF BROTHERS	
	OCCIP.	LAMB.
Both brothers.....	4	2
Older only	1	3
Younger only.....	3	2
Neither	5	6
	13	13 pair

COMBINATIONS WITHIN FAMILIES
BOTH PAIRS & SETS OF THREE

Both types	5	(5)
Occipital only	7	(4)
Lambdoid only	3	(6)
Neither	2	(2)

FOUR SETS OF THREE BROTHERS

BIRTH ORDER	OCCIPITAL			LAMBDOID		
	1	2	3	1	2	3
#1	P*	A†	P	A	A	A
#2	A	A	A	P	P	A
#3	P	A	P	A	P	A
#4	P	A	A	A	A	A

HANDEDNESS, ASYMMETRY, AND FLATTENING

In table 4 we saw that over a third of our series had asymmetrical heads; that is a high ratio. Facial asymmetry, on the other hand, was negligible. With an abnormal amount of cranial asymmetry, and the indication that much if not all of the flattening might also be abnormal, it seems worth while to explore the possibility that these 2 features are associated. First, however, it must be explained how we judged which side the asymmetry was on. An asymmetrical skull bulges to one side or the other. When a skull bulged to the left, we called it left cranial asymmetry, and the converse. When the skull was both asymmetrical and flattened, the plane of flattening pointed to the opposite side from that designated.

TABLE 25: HANDEDNESS, ASYMMETRY, AND FLATTENING.

OCCIPITAL		
ASYMMETRY	ABS.	PRES.
	549	188
	131	199
Q = + .63		
LAMBDOID		
ASYMMETRY	ABS.	PRES.
	387	210
	293	177
Q = + .06		
OCCIPITAL FLATTENING ABSENT		
CRANIAL ASYMMETRY	HANDEDNESS	
	L	R
	7	47
	5	127
Q = + .58		
OCCIPITAL FLATTENING PRESENT		
HANDEDNESS		
	L	R
	12	45
	2	138
Q = + .89		

Table 25 shows a definite tendency for men with occipital flattening to have cranial asymmetry as well; a little more than half the occipitally flattened heads are also asymmetrical. Men with lambdoid flattening may or may not have cranial asymmetry; in their case the association is a chance one. This seems

logical enough if flattening is caused by cradling. A baby lying on his back might strain to turn to one side, and if he habitually chose the same side, that side might be expected to bear the bulk of the flattening. On the other hand if the top of his head were pressed against the headboard, which side he turned to would make little difference.

The way to test this second theory is to see whether or not occipital flattening and handedness are associated. The frequencies for handedness are given on table 4. We tested for handedness by seeing which hand the man put out to take the dynamometer, and if he seemed to hesitate, by asking him to throw a stone. A total figure of 7 per cent for left handedness seems reasonable for a country where almost no one is literate, and where the only compunctions about which hand to use lie in the field of eating and its ultimate result.

Table 25 also shows that handedness is associated with cranial asymmetry in any case; in the men who were not occipitally flattened, it reached a Q of $+.58$, but in those who were so flattened, it attained the nearly complete association of $+.89$. What this seems to mean is that the babies who were right handed had a tendency to roll over on the left to free their right arms, and to look with their right eyes, etc., while the babies who were left handed had a tendency to do the opposite. It would be very strange if these movements would distort the skull, or be associated with such distortion, without benefit of cradle.

THE BOSTON EVIDENCE

The best kind of evidence, of course, is experimental. Although it was impossible to experiment with the Ghegs, a full-dress experiment of exactly the kind we need was conducted unwittingly for us by a group of several thousand Tosks. Shortly before World War I a whole village, Katundi, pulled up stakes and moved to America. Most of them settled in the neighborhood of Boston, where they were joined by others from neighboring villages. The anthropological problems presented by this migration have yet to be studied as a whole, and their investigation should yield much profit in years to come. For the moment a slight beginning may be made, which will serve the purposes of the present report.

During the winter of 1946-47, 2 graduate students in the Harvard Department of Anthropology, despite busy programs, undertook to measure and observe a sample of the colony, including both Albanian-born and American-born (fig. 16), cradled and uncradled. They measured 37 adults of both sexes who had been born in Albania, and cradled, and 30 individuals, also of both sexes, born in America, of whom only 12 were 20 years old or over.

Table 26 gives the results in the categories of occipital and lambdoid flattening. Only one person born in Albania lacked any kind of flattening; he is Mr. Peter Peterson, whose picture may be seen on plate 14, fig. 3, of "The

Races of Europe." With a cephalic index of 91.5, he is a living argument that cradling may in some cases raise the cephalic index without producing flattening; persons with this index who were not cradled are exceedingly rare.

Nearly three-fourths had occipital flattening, while two-thirds had lambdoid as well. Of the 46 per cent with both, many had pronounced flattening in 2 planes, separated by an angle. Three were flattened at such an angle that it was necessary to decide arbitrarily between the 2 categories. On the blank used no place had been assigned for +++, or it would have been used. Although no sex difference appears in presence or absence of flattening, in both occipital and lambdoid flatten-

TABLE 26: TYPE OF FLATTENING.

BIRTHPLACE	ALBANIA		AMERICA		AGES		
	#	%	#	%	5-14	15-19	20
No flattening.....	1	2.70	4	13.33	0	2	2
Occipital only	11	29.73	4	13.33	2	0	2
Lambdoid only.....	8	21.62	20	66.67	8	5	7
Both	17	45.95	2	6.67	1	0	1
Totals	37		30		11	7	12

DEGREE OF FLATTENING

	OCCIPITAL				LAMBDOID			
	ALBANIA		AMERICA		ALBANIA		AMERICA	
	#	%	#	%	#	%	#	%
Abs.	9	24.32	24	80.00	12	32.43	8	26.67
sm	1	2.70	3	10.00	10	27.03	12	40.00
	17	45.95	1	3.33	7	18.92	8	26.67
	10	27.03	2	6.67	8	21.62	2	6.67
	37		30		37		30	

SEX DIFFERENCES

ALBANIAN-BORN			AMERICAN-BORN		
FLATTENING	MALE	FEMALE	FLATTENING	MALE	FEMALE
ABS.	1	0	ABS.	2	2
PRES.	21	15	PRES.	14	12

SEX DIFFERENCES

	ALBANIAN-BORN				AMERICAN-BORN			
	OCCIPITAL		LAMBDOID		OCCIPITAL		LAMBDOID	
	♂	♀	♂	♀	♂	♀	♂	♀
Abs.	4	5	6	6	12	12	3	5
sm	1	0	4	6	3	0	6	6
	8	9	6	1	0	1	5	3
	9	1	6	2	1	1	2	0
Total	22	15	22	15	16	14	15	14

ing, the men showed much more marked degrees than the women. It would be hard to find anywhere a more flattened group. These Tosks are much more flattened than the Ghegs of our series; only the tribesmen of Zadrina and Malsia e Madhe approach them. The Tosks, however, characteristically have both lambdoid and occipital types at once while among the Ghegs a combination of the two is rare. The Tosks are also stockier, heavier, hairier men than the Ghegs, and more frequently bald. Racially they appear to be typically Alpine, whereas the Ghegs are more typically Dinaric, in the classic sense.

The children of these people, born in America and treated in infancy in exactly the same fashion as other American children, differ from their parents, as might be expected. Four out of 5 had some lambdoid flattening, while only one out of 5 had the occipital variety. In the frequencies of degree of occipital flattening a regular descending progression is seen from absent to *sm* to + to ++, which is what one would expect for the incidence of a minority character were it acquired through the same agency as its absence. This is the opposite situation from that seen among the Ghegs and the Albanian-born Tosks. The degrees of lambdoid flattening also assume a normal distribution, with the peak at *sm*. Two uncradled males with lambdoid flattening also had bathrocephaly. Small as this series is, it is highly suggestive.

Flattening of both varieties appears in early childhood, and probably in infancy, among the American-born. It seems not to increase with age. Lambdoid flattening is just as frequent among the uncradled as among the cradled, but among the latter it is much more marked. From this evidence one can only conclude that when it appears as a small area of flattening only it is probably genetic, but that when cradling is added the area increases. Occipital flattening is found among only 6 out of 30 of the uncradled. Three of these 6 were traces to slight. Of the other 3, one with + was an 11-year-old girl; the other 2 had ++. Of these, one is a younger brother of Mr. Peter Peterson, aged 24. There can be no question whatever in his case. He was not cradled. The other is a 33-year-old woman born in Maine. In her case we are not as sure. Occip-

ital flattening is probably also genetic at times, or produced by other environmental influences of which we are not aware. When it occurs with the frequency and to the degree shown by the cradled Tosks, we may be reasonably sure that the cradling is responsible for most, but not necessarily all, of it. The Boston Tusk population urgently needs a thorough study, while the old people who led the colony across the ocean are still with us, and before the young people are dispersed.

THE ANTHROPOMETRY OF FLATTENING

Returning to our Gheg series, we may survey the effect of both kinds of flattening on the major dimensions of the head, and on the cephalic index, as shown in table 27 and figure 7. Constants were also seriated for stature, minimum frontal, bizygomatic, bigonial, total face height, upper face height, nose height, nose breadth, and the nasal index. Since all of these drew complete blanks except bizygomatic, we may conclude with confidence that within present limits cranial vault form has nothing whatever to do with any of them except the width of the face, either genetically or mechanically. Furthermore, the failure of such sensitive criteria as face height and nose height to change with type of flattening confirms the independence of these latter from the influences of age, once the sutures have entirely closed.

The dimensions of the vault sort themselves out into 2 categories; those that are nearly identical with each other and those that approach or attain statistical significance. In head length, *lambdoid* and *both* are the same; in the breadth, *lambdoid* and *neither*. In the height, *occipital* and *both* are the same; in the cephalic index all are different.

It is interesting to observe that lambdoid flattening, despite its position, still causes a little shortening of the head, and that the men with both types of flattening follow those with lambdoid only in this dimension. In breadth, however, the lambdoidally flattened heads follow the unflattened, while the men with both take their breadth from their occipital flattening. As one would expect, lambdoid flattening carries with it the lowest values for

head height and occipital the highest. The men with *both* follow the occipital line, while those with *neither* are between. Whatever else a man may have, lambdoid flattening prevents his head from being shortened beyond a certain degree; if he has occipital flattening he is sure to have a broad and high vault. As one

This increase in face breadth, though significant, is not great. Another element in this complex is the nasal profile, which seems to grow more convex as the occiput becomes more flattened. The significance of this, if any, may be seen more in the steady progression of percentages of convex in the column repre-

TABLE 27: ANTHROPOMETRY AND FLATTENING.

	VAULT DIMENSIONS			
	ONLY OCCIPITAL	ONLY LAMBDOID	BOTH	NEITHER
No.	262	402	68	335
Head lgth.	181.70 $\pm$.27	186.73 $\pm$.23	186.71 $\pm$.95	188.36 $\pm$.25
Head br.	161.50 $\pm$.23	156.93 $\pm$.19	160.10 $\pm$.44	156.10 $\pm$.21
Head ht.	129.44 $\pm$.33	126.88 $\pm$.26	129.76 $\pm$.73	128.23 $\pm$.23
Cephalic index	87.91 $\pm$.16	84.08 $\pm$.12	86.82 $\pm$.67	82.96 $\pm$.23
Bizygomatic	142.60 $\pm$.25	141.79 $\pm$.19	144.78 $\pm$.46	142.06 $\pm$.21

DEGREE OF FLATTENING AND CEPHALIC INDEX

	OCCIPITAL*		LAMBDOID*	
Abs.	737	83.56	597	85.18
sm	37	85.86	110	83.93
+	213	87.31	327	84.31
++	70	89.06	33	87.09
+++	10	92.10		
Total	1067		1067	

* Including both.

NASAL PROFILE AND FLATTENING

	CONCAVE		STRAIGHT		CONVEX		CONC.-CONV.		TOTAL
	#	%	#	%	#	%	#	%	
Abs.	54	7.30	300	40.70	374	50.75	9	1.25	737
sm	3	8.11	15	40.54	18	48.65	1	2.70	37
+	7	3.37	80	37.47	125	58.69	1	.47	213
++	5	7.14	18	25.71	47	67.14	0	0	70
+++	0	0	3	30.00	7	70.00	0	0	10
Total	69		416		571		11		1067

CONVEXITY

Occip. Flattening....	Absence	Presence
Abs.	363	374
Pres.	133	197

$$Q = .45$$

would expect, the values for the cephalic index follow a progression from *neither* to *occipital*, and a range of 5 index points. Clearly, flattening is a vital factor in the makeup of Dinaries.

In the means for the bizygomatic diameter, significant differences are seen between *lambdoid* and *both*, *occipital* and *both*, and *neither* and *both*. Lambdoid flattening does not broaden the face but apparently occipital does. The reason why *both* exceeds *occipital* only is that *both* has higher values for degree of occipital flattening than *occipital only*.

senting degree of occipital flattening than in any statistical test. It may be added that many other attributes were tested for association with head form, and none of them were found to be related. Lambdoid flattening does nothing to the face. Occipital flattening may bring about a slight facial broadening in connection with the greater broadening of the parietals, for as it separates the areas of attachment of the temporal muscles, it may, in so doing, thus spread the hoops under which these muscles pass to the mandibular condyles, which remain constant. The increase in nasal

convexity would reflect a thrusting forward, in extreme cases, of the bony structures in the sagittal line of the cranium through the region of the nasal passages.

Before this section is concluded, it might be of interest to mention that the 22 adult male Tosks measured in Boston have a mean cephalic index of 89.91, with a mode of 8 individuals at 91. The distribution is not a curve at all.

the relative frequency of occipital and lambdoid flattening that causes regional differences in head form (figs. 7, 14, 15). When the unflattened individuals in each tribal series are sorted out and reseriated, we find that in each case a lower mean is obtained than before, varying from .74 points lower in the case of Dukagin, to 2.98 points lower in Has. The complete regularity of this column provides

TABLE 28: TRIBAL CEPHALIC AND INDEX MEANS.

TOTAL AND UNFLATTENED				
	No.	TOTAL	No.	UNFLATTENED
McM	105	86.79 $\pm$.25	22	84.28 $\pm$.46
Duk	106	84.54 $\pm$.24	30	83.80 $\pm$.33
MeJ	104	83.04 $\pm$.28	41	81.22 $\pm$.40
Has	114	85.59 $\pm$.28	26	82.61 $\pm$.59
Lum	109	82.62 $\pm$.27	32	81.38 $\pm$.40
Puk	102	83.76 $\pm$.26	55	82.69 $\pm$.27
Mir	101	84.39 $\pm$.27	33	83.09 $\pm$.42
Zad	105	86.67 $\pm$.24	35	84.86 $\pm$.38
Mat	104	86.49 $\pm$.27	22	84.14 $\pm$.54
Dib	108	84.96 $\pm$.26	32	83.34 $\pm$.49

The 5 adult males born in America have cephalic indices of 76, 78, 78, 87, and 88, with a mean of 81; 3 out of 5 are as long headed as the rest of the American population, while the other 2 approximate the mean and mode of their cradled parents.

TRIBAL DISTRIBUTION OF HEAD FORM

Table 28 shows clearly that it is not merely

for its validation. If flattening alone were responsible for the differences in cephalic index, then when all flattened persons were removed the tribal means should be identical. They are not, and we have uncovered a real, probably genetic, difference in head form ranging from a mean of 84 in the west to 81 in the east. This accords perfectly with the regional distribution of facial measurements which we have already seen.

THE RACIAL POSITION OF THE GHEG MOUNTAINEERS

THIS chapter need not be long. It will consist merely of a restatement of the problem, a review of the evidence, and a conclusion.

1. The problem is, what is a Dinaric, and how does he come to be one? The Gheg mountaineers were selected as subjects for this experiment because they seemed to be the most Dinaric people in the world, and because they are located in an area ideal for controls.

2. The mountains in which they live prove to be a true refuge, difficult of access, conservative in every sense.

3. The work of the Gheg keeps him and his family busy at home. It utilizes all of the available soil, and the limit of the number of people whom it can support has long since been reached in terms of the techniques employed. The few craftsmen who come into it to work, like the castle-builders, move on. The Mountains of Giants, like the Highlands of Scotland, export men. None are imported.

4. The mountaineer chooses his bride by a time-honored system which, while sociologically exogamous, biologically keeps the genes within very close lines.

5. His political system provides local autonomy and keeps people home. Feuding keeps men home, too, or, if they lose, sees that they are exiled completely out of the mountains.

6. Religious differences help block marriage with outsiders. Neither Catholics nor Moslems will marry Orthodox. Except in a few regions it segregates Catholics and Moslems as well, and has done so for 4 centuries.

7. The historical picture is reasonably clear. Except for the lowlands along the coast, the tribal area was probably uninhabited, or nearly so, until the second half of the first millennium B.C. Illyrians moved down from the northwest, following the mountains, and settled it. Some Thracians may have entered from the east, and a few Goths straggled into the country around the fork of the Drin. No real addition to the basic Illyrian population took place until the 16th century. At that time the Turks massacred whole villages all the way

from Durazzo to Scutari, and in the region of Malsia e Madhe and the lower reaches of Dukagin. To replace the nearly exterminated population, immigrants arrived from the land from which the first ancestors of the Ghegs had come—Bosnia.

8. The series which we have studied covers all of the tribes, most of the *bairaks*, and many of the villages. Except for a few tribes within which the regional distribution is uneven, it gives a true coverage of the anthropometry of the mountain people.

9. It defines the Mountain Gheg as a Dinaric of the classic type, as expected, but with wide variations. These are concentrated in gross body size and strength, the size and shape of the cranial vault, and in a few local peculiarities such as the incidence of bilateral chins, baldness, and deep lumbar curves. The greatest uniformity is found in the breadths and proportions of the face, the dimensions and morphology of the nose, hair form and distribution, and pigmentation. The characters which are most uniform are the ones most likely to be genetically controlled; most of those which are most variable are those which the environment can affect the most.

10. Many of these latter differences can be tentatively eliminated or equated by the use of certain controls: age, dental occlusion, nutrition, and the effects of cradling.

11. A few others cannot, as, in Dukagin, the high frequency of brown hair, lambdoid flattening, bilateral chins, and broad shoulders. This points to the presence of a genetic element much less evident in the other tribes, except, in lesser degree, in Malsia e Madhe. Similarly the men of Has, who marry often with their fellow Albanians on the Kossovo plain, have a few peculiarities of their own, particularly a tendency to more baldness, more black hair, and a slightly darker skin. These characters would relate them to the people farther east.

12. Despite all the controls, an east-west gradient remains in head and face form. The people to the northwest are broader headed,

broadier faced, and shorter faced than the people to the northeast; those to the south are in between, perhaps transitional to the Lowland Ghegs. How to explain this is not clear. Perhaps the Bosnians brought in the breadth, perhaps some remnant of the pre-Illyrian populations of the coast is responsible. Wherever it came from, or however it grew, it forms a continuity with the Slavic-speaking peoples to the northwest and the Tosks to the south.

13. The regional differences which have been uncovered in spite of the controls are probably mostly genetic, although this cannot be fully tested until better material is at hand. Blood groups would help immensely.

14. The typical Dinaric has been shown to be partly the product of age and artifice. His gaunt face and hawklike nose come to him usually in middle age; his broad, occipitally flattened head is largely the result of cradling. His lean body is to a large extent that of a man who has worked hard and eaten little.

15. If one were to choose at random 1067 newly born Mountain Gheg boys from all tribes, all of the same age and at the same time, transport them to America, feed them on the fat of the land, and bring them up as the sons of wealthy and provident American parents are reared, and then measure them all at the age of 20, we would have an equated anthropometric series. It would be comparable to many others in the literature of physical anthropology. I venture to predict that the means of some of their measurements would be:

Stature	173 cm.
Relative span	103
Relative shoulder br.	22.5
Relative sitting ht.	52.5
Head length	190 mm.
Head breadth	156
Head height	128
Total face height	122
Minimum frontal	108
Bizygomatic	138
Bigonial	108
Cephalic index	82
Facial index	88
Nasal index	60

Sixty-five per cent of these young men would have dark-to-medium brown hair, 20 per cent black, and 15 per cent blond, including light brown. The skin would be fair; most of the eyes would be mixed, with the lighter shades predominant, and darks and pure lights would constitute about a fourth of the whole. Sixty per cent of the noses would have straight or slightly wavy profiles, 10 per cent would be concave, and only 30 per cent convex.

These boys would not be distinguishable from ordinary Americans, except to an expert on race, who might recognize them as different, not individually, but as a group, only by their possession of a mean cephalic index about 4 points higher than the average. Or perhaps the brachycephaly too would fade away upon transplanting; that we cannot tell.

16. If we equate the Mountain Ghegs in such a fashion with western Europeans and Americans, we find that they would be comparable to many local populations in western Germany and Austria. They are of the same basic genetic stock, disseminated widely in the Iron Age, from which most northern and western European peoples came.

17. Like most other European populations of essentially Nordic or Mediterranean (or Nordic and Mediterranean) character, they include telltale traces of pre-Nordic and pre-Mediterranean racial features, which make some of them broader of trunk, more heavily muscled, wider of head and face, blunter nosed, and heavier jawed than others. In the Mountains of Giants this element is concentrated in the northwest, in Dukagin, with a lesser incidence in Malsia e Madhe. Were the series from that confederation large enough, regional subseries would probably make this clear. It seems most likely that this element entered with the Bosnian immigration of the 16th century, although some of it may have been present in still earlier times.

18. Geography, technology, sociology, history, and physical anthropology all play their parts in the resolution of this problem. I only hope that the answer is really as simple as I have suggested.

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COLLOTYPE FIGURES 8-16



a



b



c



d

a, An isolated *kulla*, Spaç *bairak*, Mirdita. *b*, A Puka *ban*. *c*, Herder's hut, summer pasture. *d*, House in Shoshi.



a



c



d

a, Tosks dancing at King Zog's birthday party, 1929. *b*, Turkish bridge over the White Drin, near Kukës. *c*, Scene in Mati. *d*, Ferrying across the Black Drin between Luma and Mal i Zi.



a



b



c



d



e



f

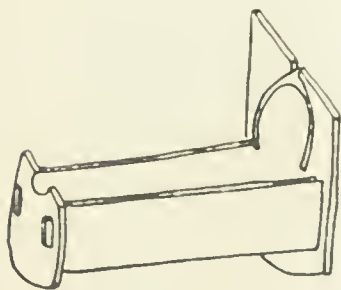
a, Prince Jon Markajon of Mirdita, with his wife, mother, and children. b, Tom Tushi, the expedition's host in Shoshi. c, Dukagjin porters resting on the pass between Merturi and Shala. d, A sworn virgin of Mirdita (right) with her friend. e, A group of Gheg *bairaktars* singing their defiance at King Zog's 1929 birthday celebration — the man in the left center is the *bairaktar* of Hoti; in the right center is the *bairaktar* of Klementi. f, A Catholic Gheg woman, probably



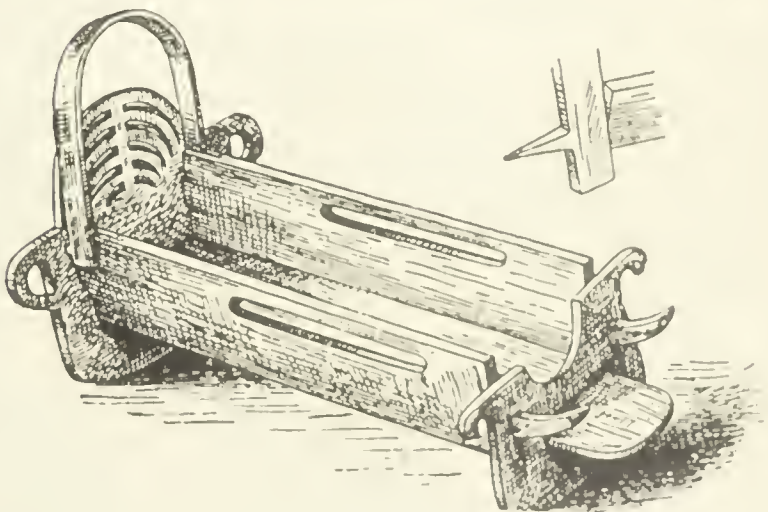
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CRADLES. *a*, Zadrina cradle. *b*, Cradle from Scutari (Haberlandt, 1917, fig. 29). *c*, Vlach cradle (Haberlandt, 1917, table 3, no. 12). *d*, Cradle from Planti (Nopcea, 1925, fig. 78).



b



c

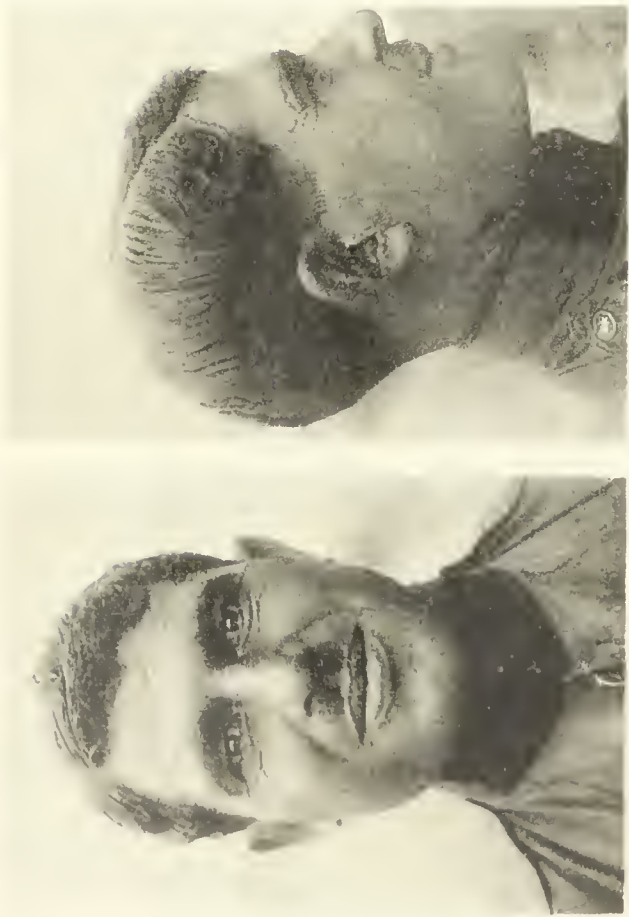


d

THE GUEG PHENOTYPE. *Standard Dinaric Mountain Gheg*: a, Zadrina tribe; age, 35; eyes, blue-brown; hair, dark brown; beard, reddish brown; cephalic index, 88; facial index, 83; nasal index, 65; stature, 151.1. b, Dibra tribe; age, 50; eyes, blue-brown; hair, black grayness; beard, red-brown grayness; cephalic index, 80; facial index, 94; nasal index, 58; stature, 178.8. *The Bosniak type of the northwestern*: c, Malsia e Madhe tribe; age, 40; eyes, blue; hair, golden; beard, golden; cephalic index, 86; facial index, 86; stature, 175.0. d, Dukagin tribe; age, 48; eyes, green-brown; hair, golden; beard, golden; cephalic index, 90; facial index, 78; nasal index, 67; stature, 190.



AGE CHANGES IN FACE FORM. 18-26-year-old group: *a*, Malsia e Jakovës tribe; age, 22; eyes, green brown; hair, dark brown; beard, dark brown; cephalic index, 84; facial index, 84; nasal index, 57; stature, 172.5. *b*, Puka tribe; age, 24; eyes, green-brown; hair, dark brown; beard, golden; cephalic index, 80; facial index, 91; nasal index, 58; stature, 174. 30-50-year-old group: *c*, Zadrina tribe; age, 30; eyes, green-brown; hair, dark brown; beard, light brown; cephalic index, 87; facial index, 82; nasal index, 48; stature, 165. *d*, Mirdita tribe; age, 48; eyes, green-brown; hair, black grayness; beard, red-brown grayness; cephalic index, 84; facial index, 80; nasal index, 59; stature, 172.3. 60-75-year-old group: *e*, Zadrina tribe; age, 60; eyes, green-brown; hair, dark brown-gray; beard, red-brown grayness; cephalic index, 89; facial index, 85; nasal index, 53; stature, 171.6. *f*, Lunia tribe; age, 65; eyes, green-brown; hair, black grayness; beard, red-brown grayness; cephalic index, 80; facial index, 85; nasal index, 58; stature, 170.7.



VARIATIONS IN HEAD FORM. *The undeformed head:* a, Luma tribe; age, 25; eyes, dark brown; beard, dark brown; hair, dark brown; cephalic index, 76; facial index, 87; nasal index, 62; stature, 177. b, Luma tribe; age, 25; eyes, blue-brown; hair, medium brown; beard, light brown; cephalic index, 76; facial index, 86; nasal index, 55; stature, 168.8. *Lambdoid flattening:* c, Dukagin tribe; age, 50; eyes, green-brown; hair, black; beard, reddish brown; cephalic index, 85; nasal index, 87; stature, 177. d, Dukagin tribe; age, 50; eyes, green-brown; hair, black; beard, reddish brown; cephalic index, 85; nasal index, 87; stature, 177.



b



c



d



a



d



c



b



a

VARIATIONS IN HEAD FORM (continued). Occipital flattening: a, Luma tribe; age, 26; eyes, green-brown; hair, golden; beard, golden; cephalic index, 96; facial index, 86; nasal index, 65; stature, 177.0. b, Puka tribe; age, 28; eyes, green-brown; hair, dark brown; beard, dark brown; cephalic index, 92, facial index, 81; nasal index, 65; stature, 170.2. Both lambdoid and occipital flattening: c, Malsia e Jakovës tribe; age, 20; eyes, green-brown; hair, black, beard, black; cephalic index, 90; facial index, 86; nasal index, 62; stature, 174.0. Barbrocephaly: d, Mirdita tribe; age, 50; eyes, green-brown; hair, black grayness; beard, red-brown grayness; cephalic index, 80; facial index, 82; nasal index, 48; stature, 162.1.



b



a



c



b



c



d



THE BOSTON TOSK. *a*, Albanian-born. *b*, American-born. *c*, Albanian-born. *d*, American-born.

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